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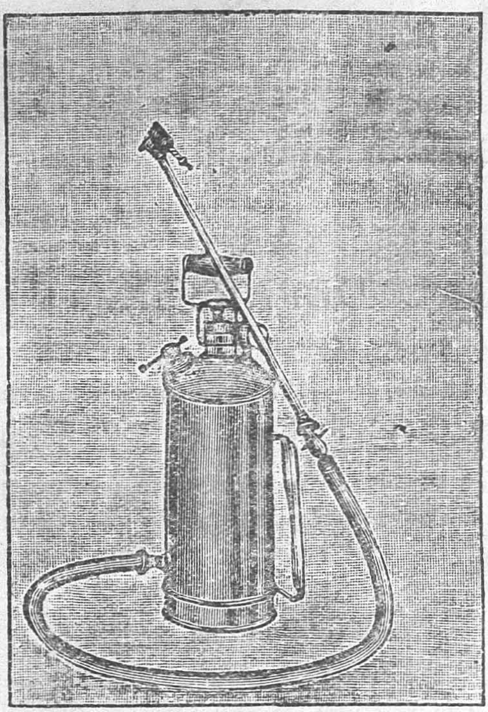

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Mr. ALLAN CARRUTH

We are sorry to report about the death of Mr. Allan Carruth, a former member of the Madras Agricultural Department and one of the patrons and wellwishers of the Madras Agricultural Students' Union.

2. Mr. Allan Carruth was the second son of Mr. William Carruth of Lawnmarnock, Renfrewshire, Scotland. He took his college course at the West of Scotland Agricultural College, Glasgow. In 1907 he became an instructor and lecturer in Agriculture under the Department of Agriculture and Technical Instruction for Ireland which he resigned in 1913 to take up the post of Country Organiser under the Edinburgh and East of Scotland College of Agriculture.

3. He joined the Department of Agriculture, Madras in April 1916 as the Deputy Director of Live-Stock and resigned it in November 1919. He was later on employed under the Board of Agriculture for Scotland as a Divisional Land Officer and was at the time of his death in charge of Land Settlement in the Eastern area of Scotland. During last August he went on a holiday trip to U. S. S. R. with the object of gaining information regarding the system of land tenure and small holdings in that country. He was suddenly taken ill and died of colitis at Odessa on 4th August.

4. Mr. Carruth was unmarried and 60 years of age at the time of his death.

5. During the short period of service in Madras, he was responsible for the starting of a Cattle Farm at Chintaladevi for the improvement of the Ongole Breed and for the selection and importation of Ayrshire bulls for the purpose of improving, by cross breeding, the Dairy Trade of Madras of which he had made a special study. The report of his enquiry was later on issued as a Bulletin of the Department. He was an excellent man among stock, as his movements were deliberate. In working out his plans he was very cautious and liked to be sure of his facts before he decided on the course of action, but having once made up his mind he stuck to the line he had laid out. We are sure that if only he had stayed long enough in the Department he would have left a mark.

6. Although his stay with us was much too short, his interest in South Indian Agriculture was immense. He was a generous patron of the Madras Agricultural Students' Union and took great interest in its progress and activities even after his departure from Madras. He never missed to send at every College Day a message of encouragement and good wishes, together with a very liberal donation.

ALLAN CARRUTH

(Patron of the Madras Agricultural Students' Union)

Formerly Deputy Director, Live-stock, Madras.

(Life sketch on the reverse)

Madras Agricultural Journal

(ORGAN OF THE M. A. S. UNION)

Vol. XXV] JANUARY 1937 [No. 1.

Editorial.

1937. We wish all our readers and every member of the Madras Agricultural Students' Union a very happy and prosperous 'New Year'.

Ourselves. The Madras Agricultural Journal enters on its twentyfifth year of existence, with this edition. And even at the risk of being accused of self-conceit we would like to express our pleasure and pride at the fact that it has been possible for this journal to render its readers an uninterrupted service of a quarter of a century, an achievement which in itself any journal could be proud of and that due solely to the selfless work of a band of honorary workers who could ill spare the necessary leisure from their legitimate official duties. To our old customers we would repeat our old pledge "to continue to serve them as well in the future as in the past" and as regards our prospective patrons we will only say, again in the words of the old tradesman, "try us once and you will never leave us."

The New King. It is just a year since we announced in these columns the sad news of the death of King George V of revered memory. Before the year closed there has been another change in the person of the British Monarch. This news is, by now, well known to all our readers and we don't therefore propose to give any details of the unhappy affair. "The whole thing was a nine days' wonder." In whatever light the whole affair is viewed nobody can deny that the ex-king Edward VIII made his exit in a manner worthy of a great and courageous ruler. We wish the Duke of Windsor, as he is now known, long life, peace of mind and above all the happiness in search of which he relinquished the throne of the great empire over which the Sun never sets.

In his successor King George VI we have a prototype of the father. We join in the respectful and loyal felicitations accorded to him and his consort Queen Elizabeth and wish them a long and prosperous reign in the years to come.

The New Constitution. In less than two months from today thirty million inhabitants of this great country will be called upon to exercise their right of electing representatives to the various legislative bodies in accordance with the provisions of the reformed constitution. Politics is not in our line, but the occasion is unique in many ways and our readers will bear with us if we propose to touch on a matter which will engage the attention of these legislatures perhaps not long after their inauguration. We refer to the question of the

"Security of the Services" in which every member of the M. A. S. U. or at least a large majority of them will be interested. The leaders of some of the better organised political organisations in this country appear to be under the impression, as evidenced from their utterances that the only sure and speedy cure for all the ills which the Indian ryot is suffering from is the drastic reduction of the salaries of the existing civil service. We do not for a moment deny that there is considerable disparity in the scales of pay drawn by officers in the different services, for which there is little or no justification and that reduction in the present scales is perhaps desirable at least in some of the services, especially in the higher grades. But as the President of the Indian Officers' Association ably put it recently "at the same time it is equally important that the conditions of service are not allowed to become the sport of parties". We would crave the indulgence of our readers to quote a few more sentences from the above speech which are relevant to the point at issue. He continues "they (the services) have a long history behind..................Freakish proposals based on simple *apriori-formulae* unrelated to any principles............ will do the greatest possible damage. Nothing undermines the contentment and efficiency of a permanent civil service as a feeling of insecurity or uncertainty as to pay, prospects and pension. We will conclude by subscribing to the hope expressed by H. E. Lord Erskine in reply to the above speech in the following words. "I think the future ministers will have far too great a sense of what will be in their own interest to damage an efficient and loyal service".

There are other matters connected with the new constitution as important as the one referred to above and more directly connected with us as agriculturists. These, we will leave for consideration in some of the later issues.

The Indian Science Congress. As we write, the congress is meeting in the capital of His Exalted Highness the Nizam of Hyderabad and Berar. This year's deliberations are guided by Rao Bahadur T. S. Venkataraman, one of the oldest members of the M. A. S. U. and once editor of this journal. We wish the congress a very successful session under his able guidance.

The World Situation. The miserable state through which the world trade was struggling during the last few years is just showing slow but sure recovery to more favourable conditions. The prices of agricultural produce have started indicating an upward curve, at least in respect of some of the commodities which have a ready foreign market. But the same hopeful feature is not evident in the political atmosphere. In Europe and the Far East things are getting from bad to worse and as far as we know it would be nothing less than a miracle if the clouds pass off without throwing out the ominous spark, leading to a world conflagration, perhaps sooner than later. We sincerely wish however, that our fears may prove to be groundless.

POSSIBILITIES OF TRACTOR PLOUGHING IN BELLARY AND ANANTAPUR DISTRICTS

BY K. SANJEEVA SHETTY, B. Sc., Ag.

The figures furnished by the Board of Revenue reveal that there is a large area under cultivable wastes other than fallow in this Presidency. Such areas are considerable in districts of low rainfall, where nature is partly responsible for these lands being not brought under proper cultivation. The area under cultivable waste in Bellary district is estimated to be 299000 acres and in Anantapur 633000 acres. Such large areas exist also in other districts of the Presidency.

It is estimated that to make the Presidency self-sufficient in the matter of food and other crops the additional acreage required to produce the present deficit is as follows:—

Rice	560000	acres,
Wheat	37000	,,
Linseed	4400	,,
Gingelly	113500	,,
Pulses	48000	,,
Betel nuts	14000	,,
Sugarcane	36000	,,

The question whether the existing cultivable waste can be reclaimed and utilised for the growing of crops in which there is a deficit in the Presidency may be examined.

The scope of this little note is to suggest among other things whether the introduction of mechanical power would not create an entirely different situation by affording facilities for the conversion of a fair percentage of the total area under cultivable waste into arable fields.

The deficit in the acreage of dry crops like wheat, linseed, gingelly, and pulses in this Presidency is about 202900 acres and it is possible to make up this deficiency to some extent in the dry tracts themselves. In Bellary and Anantapur districts alone we have a total area of about 932000 acres of cultivable waste. It is true that a major portion of this cultivable waste lies not only in very barren portions of the districts but is so situated as not to permit of any cultivation. At any rate if on a modest estimate we are able to bring under cultivation at least 2 to 5 percent of the total area it should give us about 20000 to 50000 acres for the cultivation of dry crops in Bellary and Anantapur districts alone.

The Present Agricultural Condition of the Tract. Yet there is another aspect of the question. Statistics and figures often give a wrong impression of the actual situation. A study of the local agricultural conditions would show that even large areas under cultivation are left fallow from year to year owing to various causes

such as successive seasonal failures, low price of agricultural commodity and want of sufficient number of cattle to cope up with the large area. How then would it be possible to bring cultivable wastes under the plough ?

Agricultural Practices of the Tract. In these two districts we have two distinct soil types—the red and the black overlying a substratum of kankar or nodular limestone. The soils are of varying depths ranging from 1 to 4 or 5 ft. of surface soil—generally 1′—2′ not usually above 2′ except where it is transported. The red soils (mungari area) are ploughed every year with country wooden ploughs whereas the usual operation on black soils is harrowing with the guntaka. Black soils are generally ploughed deep once in 5 or 6 years with heavy iron ploughs drawn by 4 to 6 pairs of animals. A ryot in these parts usually owns a pair of bullocks for an area of about 40 acres. A black soil ryot owning 40 acres of land and one pair of cattle has to give deep ploughing to an area of 8 acres every year to complete the operation for all the 40 acres in a period of 5 years. Five pairs of animals are able to finish half an acre of deep ploughing per day and 80 pairs of bullocks are therefore required to finish the deep ploughing operation every year for a block of 8 acres or alternatively a pair of cattle has continuous work for 80 days or about 3 months in summer to finish the ploughing operation alone. Besides this operation, preliminary cultivation for the other 30 acres has to continue, thrashing of cereal crops and transporting of cotton and other agricultural commodities to the market etc, have to be attended to. The above state of affairs indicates that with the existing condition and number of cattle, it is not possible to give the optimum tillage to the lands and cultivation is in consequence spasmodic.

The Solution of the Problem. What can be done then to set matters right? The simple question arises whether an increase in the number of cattle maintained would not solve the problem. Can the ryot not have a pair of animals for a holding of 20 acres instead of 40 acres as at present? The answer is, no; it has been found that fodder scarcity is the greatest difficulty owing to successive crop failures. It is held therefore, that so long as these tracts are not free from the frequent visitations of famine, the fodder problem is bound to limit the increase of the cattle population. The only other alternative to meet the situation of improving the cultivation seems to be to introduce mechanised ploughing.

Possibilities of Tractor Ploughing. In the year 1935 the Carnatic Agricultural transporting company of Hubli demonstrated the working of their tractors in Bellary for the first time. The successful demonstrations of these tractors attracted the attention of several land owners in Bellary taluk and about 600 acres of black cotton soil were ploughed that year. The rate charged were Rs. 15/—per acre

for 15″ depth of ploughing and Rs. 8—10 per acre of 8 to 10″ ploughing. Shallow seasonal ploughing (6—8″) was also done at a cost of Rs. 4/—per acre. Deep ploughing was done in lands badly infested with Hariali (Cynodon dactylon) it was observed that the stand of the crop in the tractor ploughed lands and outturn thereof were distinctly better than in the previous years.

Deep ploughing is essentially done to eradicate Hariali and the work turned out by the tractor at a cost of Rs. 15 per acre was decidedly better than what it would be if Hariali was dug by human labour which usually costs Rs. 25 per acre. Thus there is a saving of Rs. 10 per acre in the cost of cultivation apart from the *Quid pro quo* of increased yield.

Tractor ploughing appears to be an ideal operation for Hariali ridden lands of which there is a considerable area in these districts; and the cost of this operation when compared with the cost of doing it with human labour (ordinary heavy iron ploughs are not able to work in a field over grown with Hariali) is about 40% cheaper with better results.

It has to be admitted, however, that the cost of tractor ploughing of Rs. 15 per acre is pretty high in spite of its comparative cheapness, but this rate is likely to be reduced when these operations are more regularised and made popular, and fairly large areas are ploughed every year. The demonstration of tractor ploughing has kindled the enthusiasm of some wealthy land owners of Bellary district. In 1936 more area was ploughed and attempts are now being made by a few to purchase one or two tractors for use in the district.

There is a great future for the introduction of tractor ploughing in these districts, of course, within certain limitations. Not only the cultivator feels that the lands which are now receiving insufficient tillage would be brought under better cultivation, but there is every likelihood of a large area at present lying waste being brought under cultivation.

Conditions Favourable for Tractor Ploughing. The tractor ploughing requires a fairly large area probably not less than 50 to 100 acre blocks lying fairly close, to enable easy transport of the machinery. The ploughing should commence early in the season, January to February and finish by the 15th of May to facilitate the weathering of soil and the destruction of Hariali and its roots in the hot weather.

How to Popularise the Introduction of Mechanised Ploughing. It may be argued that in these days of depression when the ryot is not able to carry on with his ordinary agricultural operations it may not be possible for him to meet the cost of tractor ploughing. It is reported that in the Bombay presidency ploughings are done with the aid of Thakkavi loans granted by the state. The company that executes the work receives payment at the rates fixed from the Government,

on behalf of the ryot. This amount is treated as a loan to the ryot in accordance with the terms of the Thakkavi loan act. This system has considerably helped the ryots in Dharwar district where tractor ploughing has been popularised to such an extent that large areas are ploughed every year. It is urged therefore, that wherever sufficient security is forth-coming and where the land owner is not already over burdened with debts the system may be adopted in the Madras Presidency as well. In my enquiries in the villages of Bellary I could gather that there is a large number of ryots willing to get their lands ploughed with the tractor if only Government loans could be secured. Doubts may also be entertained as to the advisability of large scale mechanised ploughing which in the initial stage involves the ryot in additional expenditure in a tract where, under existing conditions of nature, and precarious seasonal factors successful raising of crops is problematical. Will not this innovation deprive a part of the agricultural labourers of their employment and thus aggravate the distress of the aggrarian population?

Such fears are unfounded because the labourer on being thrown out of employment from ploughing operations will be compensated by the large area under cultivation. Larger yields may also be expected as a result of better farming methods which necessarily would involve the employment of more labour for harvesting, thrashing, and preparation for the market etc.

GREEN FEED FOR POULTRY

By H. NARAHARI RAO

The necessity of green food for poultry, specially for the growing chicken need not too greatly be emphasized. Under normal conditions, they are natural foragers and when released in the mornings they prefer young succulent grass and other edible weeds to artificial feeds. This kind of foraging tends to keep the birds in a healthy and active condition and as such this should be encouraged as far as possible.

Men with considerable experience in poultry insist on a liberal supply of green feed to the birds, as this tends not only to the egg-production, but also to keep the flock in a healthy condition.

One reason why the birds under free-range system grow much quicker and healthier than those under confinement, is that the former get the requisite quantity of green material as their food. In a poultry yard where the birds have been kept in wire netting enclosures for some days, it will be noticed that the ground becomes bare and after some time the pasture becomes totally extinct, the reason being that the birds nip all the tender shoots; so that there is no chance for the pasture to grow at all. Under the intensive and semi-intensive systems of poultry keeping, the birds do not get the required amount of green material, unless adequately supplemented.

By green feed is generally meant all kinds of greens from the stalk of some vegetables to the tender green grass. The best and the easily available are the several kinds of grasses. Tender green grass is said to be the best material for rapid growth and is equivalent to any concentrated food material. It supplies enough protein for flesh formation and contains vitamins and minerals besides providing the necessary bulk to the ration.

The green feeds supplied to poultry should be fresh and succulent and the most suitable among them are: green grass, leaves of cabbage, cauli-flower, lettuce, lucerne, berseem, pillipesara, amaranthus, drum-stick, radish, country spinach, and carrots.

During the winter months, there is an abundance of green food available, but it becomes scarce as summer approaches.

At the Agricultural Research Station, Anakapalle, at the suggestion of the Superintendent of the farm, we have been regularly following a particular system which has worked quite satisfactorily.

Shallow nursery pots 6" to 9" deep with 2½' diameter are filled in with rich soil mixed with farm yard manure. The seeds of Ganti, Ragi, mixed with a small quantity of Pillipesara are sown thick in these pots and watered. The tender seedlings will be available for use after 8 to 10 days from the date of sowing. These pots are transferred to the chicken pens both in the morning and evening for an hour each time.

With a view to study the effect of this on the growth of chicken, 7 chicks from the Rhode Island Reds, 7 from the White Leg-Horns, 6 from the Light Sussex and 4 from the Black Minorca were selected from those that hatched on the same day (i. e.) on 21—4—1935.

Four Rhode Island Reds and 4 White Leghorns got the green sprouts and 3 were the controls in each. 3 Light Sussex and 2 Black Minorcas got the green sprouts whereas a similar number formed the controls in each. The chicken were weighed and their weights recorded from 21—4—1935 to 28—7—1935.

The statement herewith appended gives details.

Breed and Number.		Experimental.		Number.	Control.	
		21—4—'35 Grams.	28—7—'35 Grams.		21—4—'35 Grams.	28—7—35 Grams.
Rhode Island Red.	... 1	42	1,059	5	44	994
"	... 2	43	1,116	6	43	804
"	... 3	37	1,178	7	46	892
"	... 4	39	died	—	—	--
White Leg Horns.	... 1	29	976	5	27	died
"	... 2	33	998	6	38	792
"	... 3	32	1,018	7	32	746
"	... 4	29	802	—	—	—
Light Sussex.	... 1	37	1,192	4	40	died
"	... 2	38	1 240	5	39	920
"	... 3	39	1,181	6	39	916
Black Minorca.	... 1	34	916	3	35	716
"	... 2	33	839	4	33	died.

From the above, it will be seen that the chicken that got the green sprouts grow much better than the controls.

It is generally presumed that chicken are not pasture feeders and are more often enclosed in a bare piece of land. The birds do suffer for want of suitable material for their proper growth. In the case of intensive poultry keeping, it is a good plan to give rest to the runs and to dig up the soil as often as necessary to encourage the growth of vegetation by sowing seeds.

"COMPARISONS BETWEEN THE SELFED AND NON-SELFED ONION FLOWER HEADS AND BETWEEN THE EARLY AND LATE FLOWER HEADS ARISING FROM THE SAME ONION BULB"

BY C. VIJAYARAGHAVAN, L. Ag.,
Superintendent, Dry Farming Station, Hagari
and
N. KESAVA IYENGAR, M. A.
Assistant in Cotton, Agricultural Research Station, Hagari

For breeding pure lines in onion, the flower heads were selfed at the Agricultural Research Station Hagari, in the season 1934. In the selfed heads very poor setting was observed and the weight of the seed also was found to be much lower than that obtained from the non-selfed.

In this crop very frequently, two heads arise from a single bulb. The first head is put forth early in the season and when the capsules of this are fully formed, the second head is produced. The seeds collected from the later heads were found to be poorer in weight than those from the earlier ones.

With the object of testing whether selfing and lateness of flowering, affect also, certain other characters of the onion, the following data were gathered.

The observations were made on large sized Dhulia onion, acclimatised here for a long time. The crop was planted during the cold weather of 1934 under irrigated conditions. In Tables I and II, the statistical values of the characters studied are given.

From Table I it is clear that for all the characters observed the values of the non-selfed heads are higher. Table II shows that with the exception of "Percentage of capsules formed" all the values are higher in the case of early heads. The better setting observed in the case of lateheads may be due to sparser distribution of the flowers in the head. The few flowers that were produced had greater scope for complete development.

Selfing in onion was found to be injurious by other workers also. As early as 1888, Charles Darwin has remarked in his classical book, 'Cross and Self Fertilization of Plants in the Vegetable Kingdom' that in onion (Blood-red, Var.) the selfed heads showed a very poor setting. Jones and Emsweller recommended for onion breeding, isolation of pure lines by selfing and a free crossing of the plants of the same stock to regain their lost vigour.

Summary.

1. "Selfing" is injurious to seed setting and other characters in onion.

2. In the case of bulbs producing two flushes of flowering it is desirable to collect seeds from the earlier heads.

References.

1. Charles Darwin, 1888. Cross and Self Fertilization.

2. Jones, H. A., and Emsweller, S. L.—Methods of Breeding onions. Imperial Bulletin of Fruit Production Vol. No. 1. Page 31.

Table I.

Comparison between 'Selfed' & Non-selfed flower heads of onion.

	Percentage of Capsules formed.		Wt. of 500 seeds in grammes.		No. of seeds per head.		Percentage of Germination.		Mean Wt. of bulbs in ounces.	
	S. F.	N. F.	S. F.	N. F.	S. F.	N. F.	S. F.	N. F.	S. F.	N. F.
No. of determinations.	10	10	10	10	10	10	9	9	6	6
Mean.	51·3	71·2	1 64	2·13	158·8	1500·6	7·667	35·56	2·667	4·55
S. E. of mean difference.	1·5711		0·03155		46·327		1·3266		0·23026	

Table II.

Comparison between the "Early" & "Late" flower heads arising from the same bulb in onion.

	No. of flowers in the head.		Percentage of Capsules formed.		Wt. of 500 seeds in grammes.		Percentage of germination.	
	E	L	E	L	E	L	E	L
No. of determinations.	17	17	17	17	17	17	14	14
Mean.	453 8	175·8	74·0	78 6	2·212	1·648	55·07	26·714
S. E. of mean difference.	4·998		0 89913		0·20722		1·3244	

CABBAGE GROWING ON THE NILGIRIS

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Among the "English Vegetables" which are eaten by Indians to a fairly large extent and which can be considered as "established vegetables", cabbage stands only next to potato in importance. Although it has not found a place in the "average village gardens" it is grown by market gardeners in the suburbs of many large towns in this country. The fact that cabbages are sold even in village shandies in recent times shows that the masses too are getting accustomed to the use of cabbage in their food.

Cabbage has been grown on the Nilgiris for over a century. Until a few years ago, it was grown, among other vegetables, in the market gardens in Ootacamud, Wellington, Coonoor and Kotagiri and their immediate sorroundings, by small growers, more with the object of meeting the local demands than as a commercial crop. It was almost always grown with other vegetables in small patches of ground of even less than one cent in extent. These market gardens are small holdings and are cultivated intensively as most of the ryots engaged in market gardening are also interested in the supply of milk in towns. They have therefore plenty of cattle manure for the needs of the garden and as the fertility of the soil is thereby maintained, an intensive cultivation is possible.

During the past decade, the production of cabbage even in market gardens has been increasing owing to demands from outside the district. On shandy days baskets containing cabbage and other vegetables are being sent to individual consumers in Madras and other towns and cabbages are also sent by train to these towns packed in gunnies, for sale.

During the past five years despatches of cabbages by rail and lorry from Ootacamund and Mettupalayam to the more important towns of the Madras Presidency have been increasing and as a result of this increase, cabbages are, during the past two years in particular, grown on "field scale". Lorries loaded with cabbages go to Coimbatore, Calicut, Salem, Trichinopoly, and even Madras once a week or oftener according to demands.

The most important reason for the rapid increase in the area under cabbage in recent years has been the fall in prices of potatoes. The chief occupation of the ryots on the Nilgiris is potato cultivation. As it is not sufficiently paying and as unemployment is increasing ryots are resorting to growing cabbages in order to supplement their income. It has been found by experience that growing cabbages

immediately after harvesting a potato crop has been profitable because the expenses and trouble are much less than if they were to grow on other lands. The preparation of the land does not involve much labour and the fences erected for the potato field would serve the cabbage crop also. For the potato crop ryots are using large quantities of fertilisers, the residual effects of which are available for the cabbage crop which follows the potato crop. In some cases the application of the available quantity of farmyard manure might alone be sufficient to produce a satisfactory cabbage crop although in some cases further application of small doses of fertilisers might be beneficial.

But such cultivation on a field scale is not possible on all lands. In the early stages of the cabbage crop, in particular, frequent watering of the plants will be necessary, especially, when rainy days are far apart. Otherwise the plants do not come up very well. Until the "heads" are formed, fairly regular watering will be necessary. Therefore, only such soils, which are near sources of water supply, can be utilised for the cultivation of cabbages. For this reason, only lands on which an irrigated crop of potato is raised are chosen for growing cabbages. The area under such irrigated crop is small and the crops are therefore raised in different months in different parts of the district. The most common seasons are February and July.

The irrigated crop of potatoes which is the most common is the February crop. This crop is harvested in June and as at this time the available supplies of potatoes are small, ryots generally get good prices for the potatoes. On account of this, the area under the irrigated crop has increased in recent years. The harvesting of this crop in June will be followed by cabbages which are planted in July-August. The cabbages come to the market in September to November according to the early or late variety grown.

The other main irrigated crop of potatoes is in July. The crop is harvested in Nov-Dec. Cabbages will follow in December-January and these will come to the market in March to May for the "Nilgiri season".

Besides the above two well marked seasons cabbages are grown on a small scale in other months also, especially in the market gardens.

The area of plots on which cabbage is grown varies considerably. In market gardens it might vary from a fraction of a cent to 2 or 3 cents each. As a field crop the area of the plots will vary between half an acre to two acres. Generally cabbages are grown in the same field only once in two years. There are many villages on the Nilgiris where cabbage is grown as a field crop and the more important of them are Adashola, Kadanad, Anikorai, Kothamudi, Ithalar, Davane, Bygamund, Jagathala, Nedugula, Sulligudu, Hittagal, Koonsholai. It is not possible to give even an approximate idea of the total area under cabbage

in the district but it may be roughly estimated at not less than 300 acres.

The varieties of cabbage differ considerably in the rapidity of growth and they are classified into "early" and "late" varieties. Early varieties generally reach maturity of "head" in 80 to 100 days while the late varieties require 120 to 150 days. They may also be classified according to the shape into "Drumheads" with flattened spherical heads and "Ox-hearts" which have oval or bluntish cone-shaped heads.

Cabbage growers on the Nilgiris generally get their seeds from the seedsmen in Poona. The varieties largely grown are Cape Largest Drumhead and Cape Early Drumhead. The price of seed varies between Rs. 5 and Rs. 6 for 4 oz. Four to six oz. of seed, according to the variety, are required to plant an acre.

A well-drained spot is selected for the seed-bed. A fairly large quantity of cattle manure is thoroughly incorporated with the soil. Seeds are sown broadcast in the prepared bed and the bed is watered. The seed is sometimes sown at intervals of time in such a manner as to provide seedlings for transplanting at intervals so that there may be production of crop for a longer period of time. The seeds generally germinate in 10 days. When the plants have come up well they are thinned out carefully so that there may be no overcrowding. When the plants are about 6 inches high, that is, in 30 to 40 days after sowing, the seedlings are lifted carefully, allowing some soil to adhere to the roots, and then transplanted in the prepared plot. Circles of about 6 inches radius are marked after forking and pulverising the soil, cattle manure is placed within each circle and it is mixed thoroughly with the soil, and then the seedlings are planted at the centre of each circle. The plants are generally 2 to 3 ft. apart according to the variety of the plant.

After transplanting, the plants must be watered frequently, especially in the absence of rains. About a month after transplanting, hoeing is done, and if the plants show poor growth, fertiliser is applied at the rate of 4 to 6 cwts per acre. Sometimes a smaller dose of the fertiliser is applied before transplanting. But this is not general.

After the hoeing and manuring the plants will grow rapidly and in a few days heads will be formed. One more hoeing is given. Heads will mature in 60 to 90 days after transplanting according to the variety. Watering is not necessary after the heads are formed unless there is continued absence of rain for over ten days or a fortnight.

Generally the growth of the plants is not uniform so that, when some plants might be ready to cut, others might be immature. This is an advantage as supplies of cabbage can be had for a fortnight or longer from the same field.

No attempt is made to produce seed and the growers are content with getting their seed from the Poona seedsmen. According to a writer, "this is not greatly to be regretted, because hereditary

influence is not strong in cabbage. A first class variety removed to a different soil and climate soon loses the characteristics for which it is valued, and as the seed is not heavy or costly, it is better to get yearly supplies from a merchant whose business is to know where the best seed is procurable than to try to save seed in India ".

The principal insect pest of cabbage on the Nilgiris is the caterpillar which eats the leaves. Besides hand-picking to some extent no other remedy is adopted by the ryots. The "Club-Root" disease is not prevalent in any appreciable extent. The "Black-Rot" disease is sometimes met with. For this also the ryot does not apply any remedy.

The cabbages produced on the field scale do not keep as well as those produced in kitchen gardens or by market gardeners. They have a tendency to rot. Cabbage should therefore be used as fresh as possible.

The cost of production of cabbages on the Nilgiris depends on several factors of which the following are the more important.

1. The expenses for the preparation of the soil for the transplanting of the seedlings will depend on whether the land is cultivated by the owner putting his own labour or by his employing hired labour for the purpose.

2. This will also depend on the nature of the soil and on the time that has elapsed between the harvesting of potatoes and the planting of seedlings and on whether there has been rain in the interval.

3. Raising one's own seedlings is less expensive than to buy seedlings from others. Seedlings cost between 4 annas and 8 annas per 100 according to the season and according to demand and supply.

4. The extent to which manuring with cattle manure and with fertilisers varies considerably. Ryots are aware of the fact that liberal manuring of the cabbage crop with fertilisers tends to produce a heavy crop and the quantity of fertiliser used depends on the ability of the ryots to buy the fertiliser. The extent to which fertiliser is used not only determines the cost of production but also the return which the ryot gets from the crop. It is therefore a very important factor.

5. The weather conditions and the quality of the seedlings produced will determine the extent of watering required. So the expenses under this head are variable.

6. Hoeing at intervals of ten to fifteen days helps the production of large heads. Generally not more than two hoeings are done. Some growers give only one. The expenditure on this item is therefore variable.

7. Transport facilities also affect the cost of production.

Considering all the above factors it is not possible to give any exact estimate about the cost of production of cabbage on the Nilgiris. It ranges between Rs. 100 to 150 per acre. An acre of cabbages would contain between 6000 and 7000 plants according to the variety used.

The marketing of the Nilgiri cabbages has to be made more efficient if cabbage growing on the Nilgiris is to pay. The market gardeners in and around the towns in the district grow cabbages only on a small scale and they always grow it along with other vegetables. The quantity they have to dispose of is not usually large and they generally sell their produce in the local shandies principally to consumers who generally pay fair prices. It is the grower on a large scale that suffers. His crop may be bought outright by some of the vegetable dealers in big towns such as Coimbatore, Salem, Trichinopoly etc. who may either fix a lump sum for the produce in the field and will arrange to cut the crop according to their necessity, and at their expense, or they may undertake to buy the whole crop and pay at an agreed rate for the quantity that they take from time to time. Some middlemen who act as suppliers of vegetables to the important towns in South India may also buy the crop in either of these ways.

Those growers who do not find such buyers take their crop every week to the local shandies and there sell them at the prices prevailing in the market. Merchants from the moffusil or their agents may also buy in large quantities for despatch to the principal towns.

If difficulty is experienced in not getting suitable buyers some growers who have their own lorries take loads to the various towns and there sell the lot at the best prices obtainable. Some others who have no such facilities may take their crop to some mundies at Mettupalayam who undertake to sell them, acting as commission agents. They get a commission of 6 pies per rupee.

The price obtained by the grower depends on several factors. In the months of April to June when the Nilgiri season is on, good prices are obtained because there is a much larger local demand and at that part of the year the competition from local produce in the large towns will also be less. At this period the price obtained by the grower ranges between Rs. 7 and Rs. 10 per 100 cabbages. After July prices go down and at the present time (October 1936) the prices range from Rs. 3 to 5 per 100. Recently one grower who had about 15,000 plants in 2½ acres in Ootacamund town sold his whole crop for Rs. 500. The buyer has to remove the cabbages from the field at his cost. They were bought by a vegetable dealer of Coimbatore who transported the whole produce to Coimbatore taking one or two loads a day. Another grower in a village near Kil-Kotagiri sold his crop of about 20,000 cabbages at the rate of Rs. 3 per 100. The buyer had to remove the crop from the field at his expense and he paid for the quantity removed then and there. At the time of writing, cabbages are sold at the rate of Rs. 2—8—0 to Rs. 5 per 100 at the Ootacamund weekly shandy.

Taking the average cost of cultivation at Rs. 125 per acre and the present selling price as Rs. 3 per 100 and 6000 plants per acre, the profit to the grower comes to Rs. 55 per acre.

JASMINE CULTIVATION AND MARKETING IN COIMBATORE

BY R. RATNAM, B. A.

Introduction. From time immemorial the jasmine has been under cultivation all over India for its sweet scented flowers. Watt (1890) records a number of uses that the plant is put to. *Jasminum grandiflorum* is reported to be extensively cultivated in Europe for extraction of the scent from its flowers. In South India, *Jasminum grandiflorum* and *J. sambaca* are very widely grown. *J. flexile* is also common. Its flowers are almost like those of *J. grandiflorum*. They are not, however, sold in the market as it is considered that they are inferior to *J. grandiflorum* in the matter of their scent.

Cultivation. *Soil.*– In Coimbatore, loamy garden soils are best suited for the cultivation of all varieties of jasmine, while clay soils are unsuited since the luxuriant vegetative growth that results reduces the yield of flowers. In gravelly soils, though the plants present a stunted growth, flowers are plentiful. It should, however, be added that the cultivation of jasmine in gravelly soils is much more difficult than it is in loamy or clay soils.

Planting —For planting jasmine, round or square pits about 2 or 3 feet deep and 1½ feet wide are dug at a distance of at least about 12 feet from one another. Pits are filled with fresh earth stored for the purpose. *Jasminum sambaca* (Tamil: *malligai*) is propagated by cuttings while *J. grandiflorum* (Tamil· *mullai*) is grown by layering, as cuttings are found to be unsuccessful. Vines of *J. sambaca* about 3 or 4 feet long cut from a fairly mature plant and rolled in coils about a foot in diameter are planted upright in the pits dug, with the cut ends buried about 6 inches under the soil. Where propagation is by layering, the planting is done at a depth of about a foot. Rainy season is best suited for the purpose. In about two months fresh shoots begin to grow. Young plants are watered every alternate day.

Propping.—Jasmine is a straggler by habit. As the shoots of the young plant spread out, they are supported by tying them loosely to sticks fixed close to the plant. When they have come about three feet high, they have to be properly trained on what is known in Tamil as a *Pandal*—a scaffolding arrangement made from bamboos for the creeper to spread. The trouble with high *pandal* is that the picking of flowers has to be done by climbing over them which is very inconvenient. There is also a belief that during the hottest part of the day, the exposed stone pillars which are usually used as standards, get heated and injure the vines encircling them. In some gardens drumstick (*Moringa*) plants are grown (for live supports) just when the

jasmine is planted so that by the time the standards have to be provided, these *Moringa* plants are tall enough to serve as verticals for the scaffold work. With a view to avoid shade, the branches of the drumstick trees are often lopped off. This appears to be a very easy and cheap method.

Flowering. In three or four years, jasmine plants begin to flower and the yield increases year after year. Each plant spreads to a radius of about six feet all round. Especially during the flowering season, shade should be strictly avoided. Flowering season varies with different varieties. *Jasminum grandiflorum* which is most profitable, commences to flower in March and continues to be in bloom till October or November. This period roughly covers both the monsoon rains. *J. sambaca* which is less paying, flowers between March and June or July. The flowering period is usually divided into three well-defined stages. Each phase of flowering covers a period of a week during which flowers are produced profusely. Then there is an interval of about a month between one flush and the commencement of the next.

After Cultivation and Manuring. Reviewing briefly the annual cultural operations, it may be stated that soon after the cessation of flowering in October-November, all watering is completely stopped. With the advancement of the cold weather, the plants begin to shed leaves. Early in January the leaves in *Jasminum sambaca* plants are completely removed and the branches are also lightly pruned. During this season no water is supplied. The plants are also dug round so as to expose the roots. They are left in this condition for about a month. Horse or donkey manure with about a fourth of tank silt, if possible, is applied at the rate of about 20 lb. per plant, and covered by replacing the earth removed from round each plant. Pan shaped beds are then made round the plants to hold irrigation water. These operations will go on till about the middle of February. At the commencement, watering is done very moderately, and the dormant vegetative buds start growing very quickly. At this stage of vegetative growth, water is supplied sparingly so as to avoid luxuriant growth lest the crop of flowers should decrease. In a fortnight or three weeks flower buds appear. This indicates the time for profuse watering till the close of the first stage of flowering. With the close of each such stage, watering is stopped completely for about a month till the appearance of fresh flower buds indicating the time when watering is to commence.

In *Jasminum grandiflorum*, the main operations outlined above are almost the same. As in *J. sambaca*, withered leaves are removed and useless and weak branches are also trimmed. To effect complete exposure of all parts of the branches to bright sunlight is the chief object in thinning out branches. Digging and manuring are done as detailed above except that equal parts of tank silt and horse manure at the rate of 25 lb. of the mixture per plant are applied. Watering is

also done in a manner similar to *J. sambaca.* Flowering, however, is continuous in *Jasminum grandiflorum.*

Details of economic returns from a garden with special notes of its management.—In a garden which is about 2½ miles from Coimbatore, there are 31 bushes of *Jasminum grandiflorum* planted in an area of about 3700 sq. ft. (about 8½ cents) in two blocks. Out of the 31 plants, 3 are about two years old, 3 more are over ten years, and the rest between six and ten years. The arrangement for watering these plants deserves special mention. A masonry cistern about 4′ × 3′ × 2½′ and capable of holding about 185 gallons of water is situated very near a deep well in the garden. This cistern is filled by two women coolies drawing water by means of a pulley. The cistern is filled thrice within a working day of 8 hours, and the women are paid at the rate of two annas for each fill. The nearest jasmine plant is about 100 feet from the cistern and water is led through masonry channels. After each fill, water is released from the cistern by means of a plug at its bottom. It is reported that on an average about three cisterns per day during the season will irrigate all these 31 bushes which are more than two years old, once in four days.

The following is the summary of the record of yield obtained in that garden.

Yield of flowers
(in Madras Measures).

		1934	1935	1936
January		...	...	...
February		...	...	...
March		7	26	4
April		4	11	15
May		39	21	89
June		109	28	110
July		180	45	110
August		56	40	77
September		44	119	12
October		18	22	5
November		32	...	12
December		3	...	...
Total. ...		492	312	434
Gross income	Rs.	118	82	115
Expenditure on watering, manuring, gathering flowers, spraying etc.	Rs.	79	67	73
Net income	Rs.	39	15	42
Calculated income per acre (approximate)	Rs.	460	180	500

The price during all these three years was the same. In this garden extensive damage due to jasmine bug was observed during the flowering season of 1935. It was only when the flowering season had far advanced that the existence of the pest was first noticed. The fact

was immediately reported to the Agricultural Demonstrator in the first instance, who arranged with the Government Entomologist for spraying with fish oil resin soap, and the pest was effectively brought under control, though late, after sustaining a heavy loss. During February 1936 the pest was again noticed and by the timely application of the same remedial measures, it was quickly brought under control. The owner of the garden in question fears that his neighbouring gardens are also infested and his efforts to influence his neighbours have met with little success.

A few remarks are necessary in regard to the method of picking flowers. Boys less than 14 years are employed for picking flowers. Each boy gathers, on an average, about one Madras Measure within two hours. The wages paid to boys are calculated at the rate of one pie ($\frac{1}{12}$ anna) per ollock ($\frac{1}{8}$ Madras Measure).

Marketing and Prices. As in all other agricultural crops, the question of marketing jasmine flowers is becoming more and more difficult. Unlike commodities like grains, these flowers being perishable, their maximum utility has to be achieved in a very short time. Hence the dealer should make the maximum amount of profit in the minimum time with the minimum of merchandize. He keeps his shop open from 8 A. M. till about 10 P. M. Either he sends his boy servant to the gardens, or the gardeners themselves deliver the flowers by about 10 A. M. In the localities around Coimbatore, the gardener usually takes up the responsibility of gathering the flowers and delivering them to the salesman. The gardener starts picking flowers by about 6 A. M., and finishes by about 9 A. M. so as to enable him to deliver the produce at the shop by about 10 A. M. At that time the buds are unopened and it is said that there is an increase in the volume by about 10 per cent before they are sold in the evening. Ordinarily purchasers go to flower bazaars only after 3 P. M.

Trade at Coimbatore. Peculiarly enough, almost all the dozen florist shops in Coimbatore are in the hands of Muhammadans and they appear to be experts in this line of trade. Besides, during the past four years, large scale street vending which till then was almost totally unknown, has come into vogue.

Some of the local florists who also own gardens have now found new competitors from Dharapuram side which is about 50 miles from Coimbatore. It is reported that in and around Dharapuram very large gardens have been established. With the aid of petromax lights, picking of buds is commenced at about 3 A. M. or 4 A. M. and the buds are packed in baskets and transported to Coimbatore by means of motor bus. This produce reaches Coimbatore market by about 10-30 A. M. It is said that these consignments are delivered in Coimbatore at 5 or 6 Madras Measures per rupee.

As for the total quantity of flowers available for Coimbatore market during each jasmine season, one of the flower merchants estimates it at about 400 Madras measures of Dharapuram flowers and about 1200 Madras measures of Coimbatore flowers. No details are available to check up these data, and they have to be taken with reserve.

Price and Trade Aspect. No exact figures are readily forthcoming regarding the cost price of flowers paid by the dealer. It is believed that at present he pays at the rate of a rupee for 3 to 4 Madras measures. Prior to 1932, the price was only a rupee for 2 Madras measures, but the competition of Dharapuram and the economic depression have brought down the prices to nearly half the original rates. It is definitely known that the cost price has nothing to do with the ability of the trader to sell all the quantity purchased by him. He generally purchases all the produce grown in a particular garden at a flat rate. Prior to 1930, when there was a dearth of flowers, the trader used to visit gardens in the neighbourhood of Coimbatore and contract with the gardener for the sale of the whole produce of the garden during a particular season. But now, the cost is calculated by the trader on the basis of the total quantity of flowers actually purchased by him day to day.

The sale price of flowers varies with the time of purchase on one and the same day. During early evenings prices are very high. A rate of Rs. 3 per Madras measure is very often quoted. But late at night, say at 9 P. M. or 10 P. M., the trader is anxious to dispose off as much as he could and the price falls to 4 annas per Madras measure which is perhaps just his cost price. During marriage and festive seasons, the prices range from as. 8 to Rs. 3 per Madras measure depending on the time of purchase.

The trader has usually an assistant who is paid a daily wage of 6 to 9 annas. Flowers are tied up sparsely along a piece of plantain fibre. It may be taken that one Madras measure will yield a length of 12 yards. The length of course depends upon the closeness of the arrangement of flower. When there is a keen demand for tied flowers accompanied by a dearth of flowers, the assistant manages to get more than 16 yards from one Madras Measure of flowers. The cheapest rate for tied flowers is six pies (½ anna) per yard. Here also the sale price has no relationship to the cost price, as the object is merely to make as much profit as possible in a short time.

Garlands for ceremonial occasions cost not less than 12 annas each. There are several varieties of such garlands with more or less amount of ornamental work and lace tuckings. From one Madras measure of flowers not more than six garlands can be made.

The jasmine trade is characterized by its uncertainty. Late at night all unsold flowers are tightly rolled and packed in plantain leaves.

The next morning the buds remain half open and a portion may be sold till fresh flowers arrive in the market. No pains are spared to scrape every copper that can possibly be obtained. It is perhaps the uncertainty of the trade that accounts for large variations in the prices. False accounting, dilatory tactics, wrong measures and breach of contract are of very common occurrence among these petty dealers.

The Future.—The economics of cultivation given elsewhere would indicate that jasmine cultivation should prove profitable; but the demand for flowers appears to be limited. There is therefore very little prospect of any large expansion taking place in the area under jasmine cultivation in Coimbatore, unless extraction of scent is carried out. No information is, however, available as to whether scent extraction can be profitably undertaken.

Summary. Details of planting jasmine and cultural operations that have to be carried out are given. Data from actual records from one of the gardens at Coimbatore are furnished with particular reference to its management. The state of the local market is then outlined. It is concluded that any large expansion in the area under jasmine cultivation in Coimbatore is not likely to be profitable under the existing conditions.

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References.

KRISHNA NAYAK, S. (1934). Jasmine (*Bhatkal Malliga*) cultivation in South Canara. *Madras Agri. J. 22*: 398—400.

WATT, GEORGE (1890). Dictionary of Economic Products of India.

SOME ASPECTS OF MALNUTRITION IN DAIRY COWS

(By J. C. J. MAUNDER, B. V. Sc.)

In dealing with this subject, I do not propose to describe any diseases caused by or attributable to malnutrition. I shall give you no details of rations to be fed to avoid malnutrition, but will endeavour to awaken you to the realities of malnutrition, for as soon as the dairy farmer begins to realise that malnutrition is a live and real thing, then shall the time be ripe to deal with the problem in greater detail.

Malnutrition can be defined as the inability of the animal to derive the raw materials necessary for maintenance of health and milk production from the available food supply.

The majority of holdings on which dairying is practised in Queensland do not satisfy the complete requirements of the dairy cow, and it is therefore necessary to supplement the grazing with hand feeding, or, on the better class of country, grazing on supplementary fodder crops such as oats, lucerne, cultivated grasses, &c.

Dairying "off grass" can only be successfully practised on the very best of our scrub lands, and to attempt it elsewhere is merely to court disaster, or, at best, a life of hard work and stagnation.

To understand the fundamentals of its requirements, it is essential to appreciate the fact that the modern dairy cow is an animal far removed from its wild prototype, and as careful breeding and selection has evolved an animal to produce a milk supply far in advance of that which nature intended, and as this factor of milk production is accentuated, so then is the necessity for supplementary feeding increased.

Nature intended cattle to roam at will with ample opportunity for selective grazing; they bred but once a year, and produced only sufficient milk to rear one calf. The modern dairy cow is confined to small areas, is expected to breed at any time of the year, having a regular oeastrus cycle of approximately three weeks, and has to produce an amount of milk enormously greater than that necessary to rear a calf.

It must be obvious that something far beyond the provision of natural pasture is essential to enable this modern dairy cow to perform the functions expected of her, and there is not the slightest doubt that the failure on the part of the farmer to recognise this state of affairs has paved the way for many of the troubles that beset stock to-day.

Let us consider, briefly, the requirements of a dairy cow.

Firstly, food stuffs must supply the energy necessary for the performance of all the vital functions, and this energy is, to a large extent, supplied by the grasses consumed in ordinary grazing.

To build up the tissues and to replace wear and tear, proteins are necessary, and, because of the additional protein requirements of the dairy cow to maintain the almost constant figure in the milk secreted, special efforts must be made to supply proteins in addition to that available in ordinary pasture plants.

A minimum mineral content of food stuffs is essential to maintain vital functions, and an additional supply of minerals is necessary to satisfy excessive demands of milk secretion and reproduction.

In determining a suitable ration to be fed to a dairy herd, it is not advisable to decide on a definite ration—so many pounds of this and so many pounds of that—rather decide on a basal ration, varying it according to the prevailing climatic and pastoral conditions, and amount of milk produced by the animal.

Where ample grazing is available, it would be unsound to feed large amounts of bulky fodders, chaff, hay, silage, &c. Protein concentrates are indicated such as the various meals, linseed meal, cotton seed, maize meal, cocoanut oil cake, plus small amounts of bulky food.

On the other hand, where grazing is poor, for example during winter, the ration must contain larger amounts of the bulky fodders necessary to distend the digestive tract, compensating for the defective grazing. In cold weather, with great loss of body heat, extra feed is needed to make good this loss and maintain body heat. This factor of additional feed to maintain body heat is strong point in favour of rugging cattle in hard winters, the amount of feed thereby saved will amply repay the monetary outlay involved.

The mineral ration should remain constant throughout the season, varying only for individual cows according to the milk produced, as all our pastures tend to be deficient in essential minerals, particularly lime and phosphoric acid irrespective of seasonal conditions.

With reference to minerals and the dairy cow, if you are to understand the particular requirements you must appreciate the following facts.

The percentage of minerals present in the milk secreted is almost constant. Take two similar cows producing equal amount of milk of equal quality, one getting a full mineral ration and the other a low mineral ration. Notwithstanding the difference in minerals supplied, the actual amount of minerals being

secreted daily in the milk is approximately the same in both animals. Where then does the mineral content of the milk come from in the case of the cow receiving a low mineral ration; it is actually derived from the reserves stored in the tissues of the animal. It has been shown in one particular case, that a cow was secreting in the milk just five times the amount of lime present in the daily ration.

It is easy to imagine to what extent this animal's lime reserve would be drawn upon throughout the lactation period. This sort of thing cannot go on, and the inevitable happens in the fundamental breakdown of the animal, manifested by one or more of the particular conditions peculiar to dairy cattle.

I assure you, that even on the best of country where supplementary feeding has not been necessary, the feeding of minerals must be practised if the maximum efficiency is to be obtained.

The most important function of the dairy cow is that of reproduction, and if a cow fails in this obligation, she no longer becomes profitable, and must be culled.

Undoubtedly, a great economical loss is represented by the large number of dairy cows affected with temporary or permanent sterility. Remember my remarks pointing out the difference between the reproductive obligations of the undomesticated cow and those of our modern dairy cow, and you must realise that some particular attention is necessary if the unnatural demands of reproduction are to be fulfilled.

Undoubtedly many of the problems of sterility are directly associated with malnutrition, and the more readily the problem of malnutrition and its relation to regular reproduction is appreciated, the more successfully are farmers likely to combat sterility.

My final reference is to dry stock—remember that although the dry cow is not producing any milk, she is providing or attempting to provide sufficient nutrition to an embryo calf in the final stages of its uterine life, and considerable demands are therefore made on the maternal reserve.

I ask, therefore, that the dry cows receive the attention that is their due when the problem of malnutrition is receiving the consideration that is essential for the successful practice of dairy farming. (*Queensland Agricultural Journal*, Vol. 46, page 67 July 1936.)

EXTRACT

Land reclamation in Italy. One of the achievements of which Italy can unreservedly be proud is the reclamation of large areas of land that for centuries remained marshy.

An idea of the vastness of the operations and their popularity may be gauged from the following figures:—

Labour employed.	18 million, man days.
Area reclaimed.	4·7 million, hectares.
Increase in out put.	2 million metric tons.
Fall in imports %.	about 80·0

Of much greater interest perhaps to this country is the way in which the Italian Government tackled what is known as the "Southern Question" consisting of a group of problems arising out of the backward economic and social conditions of South Italy. The general machinery is prescribed by the Mussolini Act which characteristically does not lose itself in the maze of existing measures. It leaves them as they are and goes straight forward. Financial provision of 7000 million lire is made to be spent in the course of 14 years. Half of this amount is chargeable to the treasury and the remainder to the land owners. The

major part of the finance is provided to the parties concerned in the form of 30 year annuities discounted to them by different institutions.

The scheme aroused such great enthusiasm that applications for funds were so numerous that the alloted sum was found far too small to meet them all. Preference was given for the execution of the work by public bodies which ensured a certain minimum of private initiative. Private rights were acknowledged and when curtailed, were said to be adequately but not excessively compensated. A special section of the Ministry of Agriculture which receives proposals and itself draws up plans, deals with land reclamation and no project is accepted unless it shows considerable possibility of securing notable improvements in hygiene, demographic, economic, and social conditions. The plan being accepted by government, the land owners proceed to execute the works either by themselves or through the consortium. They may provide all the money themselves or obtain government grants or special loans from the agricultural bank.

When the reclamation is completed, some internal migration and land settlement become necessary. A special commissariat like the "Ex-service Men's League" attended to this and the migrants were drawn mainly from farm workers brought from more densely settled regions. The system adopted was as follows:—The reclaimed land is cut up into holdings of 25 to 75 acres according to the quality of land each furnished with a house, stabling for ten cattle, poultry run, pig sty, well etc. The farms are taken by the immigrants first on a crop sharing basis the tenants receving monthly advances in the shape of supplies and cash allowances from the League or other societies. When the head of the family gets experienced, an agreement is drawn up under which he will purchase the farm and the livestock from the League in 15 annual instalments covering capital and interest which varies in general from 200 to 630 lires per hectare as cost of upkeep and amortisation of the drainage work. These repayments do not cover the government contribution.

(One hectare=2·47 acres ; 1 metric ton=2000 lbs.; 1 lire=9⅛ d.)

(Extract of a lecture on land reclamation in Italy by Sir John Russel.)

Agricultural Jottings.

BY MEMBERS OF THE DEPARTMENT OF AGRICULTURE, MADRAS

The Madras Dry Farming Scheme. The Madras Dry Farming Scheme, which was started just over two years ago, has for its purpose the improvement of agriculture in the arid parts of the Presidency. The Research Station where the work is in progress is situated at Hagari in Bellary district.

An account of the progress made in the first year has been published already. The following notes give further general information about work done in the last season, and the manner in which it may be useful to the ryot.

The progress made lies in two general directions viz., improvement of the crop, and improvement of the soil.

Improvement of the Crop. *Korra.* This millet, which is one of the main food crops, has been studied intensively. It has been found in any crop grown under ryots' conditions that the plants differ in one important respect and that they are generally of two kinds. Some have a shallow spreading root that penetrates to depth of only about 6", while others have a different kind of root which grows deep in the soil up to 2 feet and even 3 feet. It has been found that the deep rooted kinds are most numerous which is evidently nature's way of providing a kind of plant adapted to resist drought. But what of the shallow rooted kinds that are present, although not in such large numbers? The information obtained

up to the present seems to show that the latter may frequently give the best yield in seasons when the rainfall is heavy or ill distributed. The reason is heavy black soil is soon spoiled by heavy rain which interferes with growth. In a season of light rainfall, which is usual in the district, the deep rooted varieties do best, but when too much rain falls at one time, the shallow rooted kinds may give more grain.

It is well known that on many holdings there are high-lying lands, medium level fields, and low lying areas. Crops grown on the ridge suffer much more frequently from drought than on low-level lands. It is posssible, therefore, that deep rooted plants will do best generally under such conditions, whereas the shallow rooted kinds may be more suited to low-lying areas. New strains of Korra have been isolated. During the season these were compared not only at Hagari but on a number of ryots' fields. This line of work continues to be promising.

Jonna. The importance of Jonna as a food is well known in the Ceded districts. A common source of loss to the ryot is the frequent appearance of an inferior Jonna plant in fairly large numbers and in almost all crops. This is called "Jadu choppa". These plants do not produce an earhead and the cause has been traced to impairment of the root system. Efforts are being made to eliminate this loss.

Cotton. In Bellary district early season or '*mungari*' cotton is grown on about 2 lakhs of acres annually. The mixture grown frequently by the ryots spins up to not more than 15—18 highest warp counts. The lint is of inferior quality. As a result of new importations from other parts of India, a cotton of much superior quality which spins to 32's has been obtained. The variety which comes from Berar is called Verum. Wherever this cotton has been grown, it has proved to be equal in outturn of lint, as compared with the local low grade mixture. Further, it has been well reported on by a section of the cotton trade and the department of agriculture has been requested to ensure its wide cultivation.

With the advent of new strains of this variety as a result of two seasons' work, the ryot now has two types of proved quality, one for cultivation in the early season and another for sowing later.

Improvement of the soil. In the Bombay Presidency where the rainfall in quantity is about the same as in Bellary and Anantapur districts, it has been shown that as much as fifty per cent of the rainfall may be lost to the crop. This is caused in part by unsuitable cultural methods.

A similar problem exists in parts of the Ceded districts and it is being overcome to some extent by the erection of small field bunds. The implements used for this purpose is simple in design and can be drawn by a medium sized pair of animals. It costs Rs. 7—8—0. The year before last an experimental crop of cotton yielded 51 per cent more kappas than unbunded land, and last year the difference in a Jonna crop was 31 per cent in favour of the new method. Further, there has been a cumulative rise in yield per acre.

In the past the problem of drought in Utah, U. S. A. has been acute. As a result of twenty five years' experience much progress has been made in designing methods of tillage conducive to the storage of rain in the soil. It has been found that in time if land is cropped in alternative years instead of every year, the yield will double itself.

The Anantapur ryot seems to understand this practice to some extent, but his methods need improvement. A study of the possibilities of cropping in alternative years is to be undertaken at Hagari. It has been found during one season that a cotton crop can deplete the soil of moisture to an extent of 7,98,700 lbs per acre. This compares with as little as 2,55,200 lbs. per acre when no crop is grown.

An Officer of the Madras Agricultural Subordinate Service has been sent to America to study methods of dry farming practice. With his knowledge of the Ceded districts he should learn much that will be of use in improving methods of cultivation in Bellary and Anantapur district.

The place of other crops than Paddy in the Tanjore Delta. It is well known that over a million acres of land are devoted to cultivation of paddy annually in the Tanjore District without rotating it with any other crop. Of this area, about 1½ to 2 lakhs of acres are cropped with paddy twice a year while the rest of the area is devoted to a single crop. When paddy prices were ruling high at Rs. 2—8—0 to Rs. 3—0—0 a kalam of 64 lb. there was a decent margin of profit left for the cultivator even from a low average yield of 30 kalams per acre. But with the fall in price of paddy ranging from 40 to 60 per cent from 1930 onwards the margin of profit has become very narrow.

The immediate problem for the Department was to find out whether there was any possibility of introducing with success other and more profitable crops in the wet lands of the Tanjore district. From 1930 onwards experiments with various commercial crops have been under way in the Paddy Station at Aduturai. The following crops were under trial on this station so far :—Sugarcane, plantain, groundnut, soy beans, Cambodia Cotton and turmeric.

Sugarcane. The trials conducted with sugarcane of various varieties have definitely established the fact that it is quite possible to grow fairly good crops of sugarcane in the paddy fields of Tanjore. The yields per acre ranged from 25 to 35 tons and it is reckoned that an average of 30 tons per acre could be realised under proper cultivation and management. The best time for planting canes is March and April.

Of the thin canes Co. 281 and Co. 285 have been found to do very well. These canes have the reputation of standing water-logged conditions. Among the thick canes, Co. 402 is a very good cane to grow and has been given to the cultivators for trial. Co. 419 and Co. 421 under trial for the second year on the station give promise of being suitable for the tract. Among the Sorghum cane hybrids, Co. 352, 353 and 355 have been found to do well. Of these Co. 352 is ready for harvest in about 8½ to 9 months.

Canes have been introduced in all the taluks of the district. It is also gratifying that mirasdars who were new to this crop, straightaway adopted along with the new canes, the uptodate methods of cultivation. This is indeed a distinct gain.

Plantain. Generally plantain crop in the Tanjore district was confined to 'Padugai' lands adjoining river banks and it was seldom grown in paddy fields. The trial crops grown in the paddy fields during the last six years have shown that under proper cultivation fairly good crops of plantain can be grown in paddy fields of the district either for three years or more in the same field. But due to prevalence of cyclonic weather almost every year during the north east monsoon period when bunches appear on the plants, the plants have to be propped. It has been shown that it is quite possible to grow plantain in the paddy fields of Tanjore as is done in the neighbouring district of Trichinopoly.

Poovan and Monthan varieties are found to be the best varieties to grow. The cultivation of Mauritius plantain avoids the costly item of propping.

Turmeric. It has been possible to take very good crops of turmeric in paddy fields by growing it on raised beds with drainage channels at intervals. Yields varying from 16,000 to 22,000 lb. of green turmeric have been obtained. The only precaution to be taken is that the crop should be grown in July on raised beds and beyond the reach of stagnant water during the rainy months.

Groundnut. Trials made to grow groundnut in the single crop on samba fields as a catch crop before planting the fields to paddy crop during the season have proved to be very successful. Yields have ranged from 1,200 to 2,000 lb. of pods and 10,000 to 12,000 lb. of haulms which could be used either as green manure to the succeeding paddy crop or as excellent fodder for cattle. Being a legume, it enriches the field sown to it with nitrogen, the most needed plant food in our soils.

Cambodia Cotton. Trials to grow Cambodia cotton in between two samba paddy crops have proved to be of considerable promise. The cotton seeds are dibbled in lines in the stubble after the harvest of samba crop in January or February. With the available moisture, the seeds germinate and the young plants grow. With the help of summer showers the crop is given one or two courses of intercultivation with mammatty or a bullock-drawn hoe and earthed up. The crop is allowed to grow as best it can with the help of the moisture in the soil and the few summer showers. The crop is given irrigation after the receipt of water in the channels in June. Thereafter it makes very rapid growth and flushes well, bearing a heavy crop of bolls. A heavy picking can be taken before the rains in October when the crop is pulled out and the field planted to paddy. In the years of well distributed rainfall in summer, the yield of kappas from an acre has gone up to 900 lb. but an average yield of 300 to 400 lb. of kappas per acre is quite a possibility.

Tips to those Interested in Poultry. While quite a number of people like to keep poultry, their interest wanes as soon as they find things are going wrong. There has been of late, much awakening among villagers and townspeople to raise exotic breeds. While they are excellent both for the table and breeding purposes there are certain difficulties in the way of their becoming popular and remunerative at present. So long as they are subject to certain contagious and infectious diseases which play havoc among them, and so long as there are no specific remedies as at present, the safest advice one can give is to go slow in introducing such birds. Improvement can be achieved by selecting the best layers among the local types found in the country. Another way is to grade the local birds by mating the hens with good foreign cock, such as white Leghorns, Rhode Island Reds, Light Sussex, Black Minorcas, etc. By adopting these two methods alone a fair progress in the improvement of poultry could be effected.

An important point one should remember in raising poultry is that they should be housed in sanitary surroundings which should be dry, airy and roomy and should be protected against their natural enemies. The Department has in several of the agricultural farms types of poultry houses which can be adapted to suit local conditions. Poultry are subject to parasites like lice, mites, ticks, fleas, etc. which if not attended to promptly multiply rapidly and weaken the birds by sucking their blood. Therefore a good supply of disinfectant powders like a mixture of wood ashes and sulphur, sweet flag, tobacco, etc. to dust the birds should be available. Again, the birds should be fed regularly; to keep them in good condition different kinds of green food is essential. Clean water with a few grains of potassium permanganate in it should be within easy reach of birds. Also grit which would aid digestion and help in the formation of shell should be supplied.

A very important point to bear in mind always is that prevention of disease is better than cure; this is all the more necessary when no cure has been found for several of the ills of poultry. To this end, a place where the birds could be isolated as soon as the first signs of disease are noticed is very necessary. The rapid spread of diseases in the villages, is due to want of facilities in this direction. Therefore, poultry raising in villages becomes very unsuccessful. It is best that poultry are kept in fields as far as possible or in isolated places where

contact is not so intimate. In the case of diseases like chicken pox, inoculation as a preventive should be taken advantage of.

It should be the concern of every one who keeps poultry to periodically see if poultry keeping is a paying concern or not. Business methods are necessary at every step. Attention should be paid to proper marketing of eggs. Eggs should be examined first to see if they are sound or not. A good method is to place the egg against the sun or strong light and note the air space, condition of the albumen and yolk within the egg. Eggs should be graded according to their size and colour before marketing and prices fixed accordingly. If these suggestions are followed, it is possible to make poultry raising a paying proposition.

Crop & Trade Reports.

Receipt of raw cotton at press & spinning mills.

Total cotton pressed & unpressed

	Bales of 400 lbs. against an estimate of 540, 700 bales for 1935-36.	Figures for corresponding period in previous years.
1—2—35 to 20—11—36	586,412	434,633
„ 27—11—36	592,688	439,278
„ 4—12—36	597,070	444,642
„ 11—12—36	603.272	449,964
„ 18—12—36	606,931	455,964
„ 25—12—36	610,882	458,876
„ 1—1—37	616,044	462,558

	Cotton bales received at Mills.	Exports by Sea.	Imports by Sea.
1—2—36 to 20—11—36	336,378	239,524	95,934
„ 27—11—36	372.368	243,623	96,593
„ 4—12—36	378,560	248,312	98,525
„ 11—12—36	384,639	251,145	98,704
„ 18—12—36	389,220	253,775	99,484
„ 25—22—36	391,906	254,967	99,567
„ 1—1—37	396,169	259,065	99,843

Paddy—Second forecast report. The average of the areas under paddy in the Madras Presidency during the five years ending 1934—35 has represented 13·4 percent of the total area under paddy in India.

The area sown with paddy up to the 25th November 1936 is estimated at 8,504,000 acres. When compared with the area of 8,410,000 acres estimated for the corresponding period of the previous year, it reveals an increase of 1·1 per cent.

The increase in area occurs in Vizagapatam, West-Godavari Kurnool, Chingleput, Trichinopoly, the South and West-Coast. There is a marked decrease in area in Nellore (130,000 acres) owing to the unfavourable season.

The first crop has been generally harvested throughout the Presidency.

Normal yields have been reported from all districts outside the Circars (Vizagapatam excepted) Bellary, Anantapur, the Carnatic districts, North Arcot and Salem. The severe cyclone of the 28th October lodged the crop in parts of East Godavari, West Godavari, Kistna and Guntur.

The seasonal factor for the Presidency works out at 98 per cent of the average as against 95 per cent in the corresponding period of the previous year.

The wholesale price of paddy per imperial maund of 82 2/7 lb. as reported from important markets towards the close of November 1936 was Rs. 2—14—0 in

Vizianagaram and Madura, Rs. 2—13—0 in Cuddapah, Rs. 2—11—0 in Salem, Rs. 2—10—0 in Nellore, Rs. 2—6—0 in Nandyal, Vellore and Erode, Rs. 2—5—0 in Guntur, Rs 2—1—0 in Cocanada, Rs. 1—15—0 in Tinnevelly, Rs. 1—13—0 in Kumbakonam, Rs. 1—12—0 in Negapatam and ranged from Rs. 2—2—0 to Rs. 2—3—0 in the other markets. As compared with the prices reported for October 1936, the prices are stationary in Vizianagaram, Nellore, Vellore, Salem, Erode, Kumbakonam. Negapatam, and Tinnevelly while they reveal a fall of one per cent in Trichinopoly and 2 per cent. in Cuddapah and a rise of 8 per cent in Cocanada and 2 to 3 per cent in the other markets.

Sugarcane—1936—Intermediate Report. The cyclone of the 28th October 1936 lodged the sugarcane crop in parts of the districts of East Godavari, West Godavari, Kistna and Guntur. In the districts of Kurnool and North Arcot, the crop suffered to some extent from drought in the early stages of its growth. The condition of the crop is satisfactory in the other districts and the yield is expected to be normal if the season continues to be favourable.

The wholesale price of jaggery per imperial maund of 82-2/7 lb. as reported from important markets towards the close of November 1936 was Rs. 5—12—0 in Madura. Rs. 5—10—0 in Rajahmundry, Rs 5—9—0 in Nandyal, Rs. 5—8—0 in Adoni, Rs. 4—15—0 in Bezwada, Guntur and Kumbakonam, Rs. 4-14-0 in Mangalore, Rs. 4—12—0 in Masulipatam and Tuticorin, Rs. 4-11-0 in Calicut, Rs. 4-7-0 in Erode, Rs. 4—5—0 in Ellore and Coimbatore, Rs. 4—2—0 in Salem, Rs. 3—11—0 in Bellary, Rs. 3—10—0 in Cocanada, Rs 3—8—0 in Cuddapah, Rs 3—4—0 in Trichinopoly, Rs. 3—2—0 in Vellore and Rs. 2—8—0 in Vizagapatam. As compared with the prices of the previous month, these prices reveal a rise of 30 per cent. in Rajahmundry, 11 per cent. in Trichinopoly, 8 per cent. in Salem, 7 per cent. in Kumbakonam, 6 per cent. in Coimbatore and Calicut, 4 per cent. in Guntur, 3 per cent. in Nandyal and one per cent. in Ellore and fall of 17 per cent. in Vizagapatam, 9 per cent. in Adoni, 5 per cent in Cocanada and Cuddapah and 3 per cent. in Mangalore whilst they remained stationary in the other centres.

1936-1937—Cotton—Third Forecast Report. The average of the areas under cotton in the Madras Presidency during the five years ending 1934-35 has represented nine per cent. of the total area under cotton in India.

The area under cotton up to the 25th November 1936 is estimated at 1,982,100 acres. When compared with the area of 2,200,900 acres estimated for the corresponding period of last year, it reveals a decrease of 9·9 per cent.

The decrease in area occurs in all the important cotton growing districts outside Salem, Coimbatore and Madura. In the Deccan, the area has fallen from 1,169,000 acres to 961,000 acres i. e. by about 18 per cent. owing to want of timely and sufficient rains.

The area under irrigated cotton mainly cambodia is estimated at 198,800 acres as against 206,700 acres in the corresponding period of last year, a decrease of about 3·3 per cent.

Pickings of the early sown crop in Bellary are in progress and the yield is expected to be below normal. In the districts of East Godavari, West Godavari, Kistna and Guntur the crop has been affected to some extent by the cyclone of the 28th October 1936.

Normal yields are expected in all the districts outside East Godavari, West Godavari, Kistna, Guntur, Bellary, Anantapur, Cuddapah and Nellore. The seasonal factor for the Presidency works out to 96 per cent. of the average as against 100 per cent. in the previous year. On this basis, the total yield is estimated at 412,000 bales of 400 lb. lint as against 456,000 bales of last year, a decrease of 9·6 per cent. The crop is young and it is too early to estimate the yield with any degree of accuracy.

The estimated area and yield under the several varieties are given below :-

(Area in hundreds of acres, i. e. 00 being omitted, yield in hundreds of bales of 400 lb. lint. i. e. 00 being omitted.)

Variety.	Area from 1st April to 25th November.		Corresponding yield.	
	1936	1935	1936	1935
1	2	3	4	5
	Acs.	Acs.	Bales.	Bales.
Irrigated Cambodia	187,3	196,2	117,1	122,7
Dry Cambodia	227,5	217,1	49,4	46,5
Total Cambodia ...	414,8	413,3	166,5	169,2
Karunganni in Coimbatore ...	102,0	95,5	23,5	22,0
Uppam in the Central districts ...	29,0	27,9	4,7	2,6
Nadam and Bourbon	18,5	2,6	9	1
Total, Salems ...	149,5	126,0	29,1	24,7
Tinnevellies*	311,0	344,0	80,1	88,6
Northerns and Westerns ...	961,0	1,169,0	111,1	146,2
Cocanadas	137,8	139,9	24,2	26,2
Others	8,0	8.7	1,0	1,1

* Includes Uppam, Karunganni and mixed country cotton in Madura, Ramnad and Tinnevelly.

The local cotton trade is not generally active at this time of the year. The wholesale price of cotton lint per imperial maund of 82-2/7 lb. as reported from important markets towards the close of November 1936 was Rs. 19-12-0 for Cocanadas, Rs. 25-11-0 for Red Northerns, Rs. 18-11-0 for early crop Westerns, Rs. 25-4-0 for Cambodia, Rs. 24-2-0 for Coimbatore Karunganni, Rs. 22-4-0 for Tinnevelly Karunganni, Rs. 21-12-0 for Tinnevellies, and Rs. 21-4-0 for Nadam cotton. As compared with the prices in the previous month, the prices of Tinnevelly Karunganni and Tinnevellies reveal a fall of about 4 per cent. and 2 per cent. respectively, and of Cambodia a rise of about 2 per cent. while the prices of the other varieties are practically stationary.

Castor—1936—*First or final report.* The average of the areas under castor in the Madras Presidency during the five years ending 1934—35 has represented 19·5 per cent of the total area under castor in India.

The area under castor in the Madras Presidency up to 25th November 1936 is estimated at 240,100 acres. As compared with the area of 247,700 acres estimated for the corresponding period of last year, it reveals a decrease of about 3·1 per cent. The estimate for last year was below the actual area of 252,291 acres by about 1·8 per cent.

There was an increase in area in East Godavari, Kurnool, Anantapur, Salem, Coimbatore, Trichinopoly and Madura which was more than counterbalanced by a decrease in area in the Circars (East Godavari excepted), Bellary, Cuddapah, Nellore and Chittoor.

The seasonal factor for the Presidency is estimated to be 97 per cent of the normal as against 88 per cent in the previous year according to the season and crop report. On this basis, the yield is estimated at 23,600 tons as against 24,300 tons estimated for the corresponding period of last year and 22,750 tons estimated in the Season and Crop report of last year.

The wholesale price of castor seed per imperial maund of 82 2/7 lb. as reported from important markets towards the close of November 1936 was Rs. 5-7-0 in Vizagapatam and Ellore, Rs. 5-6-0 in Vizianagaram, Rs. 5-3-0 in Rajahmundry, Rs. 5-1-0 in Cocanada, Rs. 5-0-0 in Bezwada and Cuddapah, Rs. 4-14-0 in Vellore, Rs. 4-12-0 in Masulipatam and Bellary, Rs. 4 11-0 in Trichinopoly, Rs. 4-9-0 in Nandyal, Rs. 4-7-0 in Salem, and Rs. 4-2-0 in Tinnevelly. As compared with the prices reported at the corresponding date of last year, these prices reveal a rise of 14 per cent in Cuddapah, 9 per cent in Ellore, 8 per cent in Vizianagaram, 5 per cent in Vizagapatam, 4 per cent in Rajahmundry and Vellore and 1 per cent in Cocanada, Nandyal and Trichinopoly and a fall of 20 per cent in Bellary, 12 per cent in Tinnevelly and 1 per cent in Salem whilst they remained stationary in the other centres.

College News & Notes.

Mr. R. C. Broadfoot, Principal and Ex-Officio President of the M. A. S. U. returned from leave and took charge on 30-12-'36 from Mr. K. Ramiah who was in additional charge of the Principal's Office from 23-12-'36. Mr. R. W. Littlewood left for Hosur on 6-1-'37. The same day Mr. D. G. Munro left for Cochin enroute to England, on leave.

Students' Corner. The College reopened after the Xmas and New Year holidays on the 4th January. Students of the 2nd year B. Sc., have gone on tour.

Departmental Notifications.

Transfers & Postings. Mr. N. Ganeshamurthy, A. D., Salem to be A. D., Harur; Mr. P. Appaswamy Pillai, A. A. D. on leave to be A. A. D., Salem; Mr. V. Satagopan, A. D., Coimbatore deputed to the Botanical Sub Station, Pusa for training in flue curing of tobacco; Mr. T. K. Thangavelu, A. D., Coonoor to be A. D., Coimbatore; Mr. K. G. S. Bhandary, A. D., Ootacamund to be in additional charge of Coonoor sub-circle; Mr. N. Srinivasa Rao, A. D., Tirupur to be A. D., Pollachi; Mr. B. G. Narayana Menon, A. D, Pollachi to be A. D. in the Co. 2 Scheme.

Leave. Mr. A. Abdul Samad, Dry Farming Station, Bellary, l. a. p. for 30 days from 4-12-'36 with permission to prefix the Xmas and New Year holidays; Mr. R. Kolandavelu Naicker, A. D., Peruvani, extension of l. a. p. for 2 months on m. c; Mr. A. Gopalan Nair, F. M., Taliparamba extension of l. a. p. for 3½ months on m. c. from 23-12-'36; Mr. P. Kesavanunni Nambiar, A. D., Co. 2. Scheme, l. a. p. for 2 months from 23-12-'36.

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Editorial.

Agriculturists and Land Mortgage Banks. Our readers will be aware of the fact that the indebtedness of our agriculturists and the means of rescuing them from the grip of the money lenders are of late engaging the earnest attention of the Government and the Public and that the development of Land Mortgage Banks is an earnest endeavour in that direction. It may be recalled that these institutions are being started since 1925 with the threefold object of liquidating prior debts, of improving the existing lands, and of helping the agriculturists in the purchase of lands afresh. We however, find from most of the reports of these banks that they are more concerned with the first of these activities, and that the kind of relief afforded, forms only a very small proportion of the total indebtedness in the areas they are aimed to serve. We observe further that even in the case of persons benefited by these loans, there are fairly large arrears in the repayment of instalments especially in the Punjab, Bombay, Mysore and Central Provinces. We are gratified to note that Madras is considered to be far in advance of other Provinces in the matter of working these banks successfully with less defaults and at lowest rate of interest. This should not however be taken to indicate that in Madras there is model for other Provinces to secure unfailing success. The co-operation-mindedness of the debtor-ryot is a *sinequinon* for such success, and this cannot be said to obtain since the Madras agriculturist is as ignorant of co-operative principles as his confreres in other Provinces.

We note, in the October issue of the Indian Co-operative Review in which the present position of these banks has been discussed in a detailed and critical manner, that the proud position of the Madras Bank is due mainly to the great caution exercised in locating the primary banks in the more favoured tracts of the Presidency and to the kind interest taken by the Madras Government in guaranteeing the debenture holders both principal and interest and by declaring them as trustee securities. Very probably the moment the protecting hand of Government is withdrawn, the plight of the Madras Banks would also become more too enviable. Further it would be necessary sooner or later to extend the operations of the bank to tracts where the agriculturist is not quite as sure of his produce as in the deltas and when this comes to be, the authorities of the Land Mortgage Banks will be hard put to retain the present high standard. Surely some arrangement which would induce and at the same time help the agriculturist to pay up his instalments regularly will have to be thought of and put into operation.

We may mention here that the present rot in the working of the Land Mortgage Banks set in with the beginning of the world depression and that the defaults in the payment of instalments are not due to any decline in the productive capacity of the land, but to the fall in prices which has reduced the monetary value of the agriculturist's income, their liabilities with regard to land revenue and repayment of principal and interest of their loans remaining the same. If a method could be devised by which the fluctuations in agricultural prices could not be much felt by the debtors, the repayments of instalments will tend to be more regular and the financing banks as well as the producers of raw materials will be relieved of their periodical anxieties.

It looks to us that commutations of cash obligations into those of the agricultural commodities of the tract on the basis of the then existing prices and treating them in the same way as long term cash loans with regard to the fixing up of instalments to be paid in kind would go a great way to ameliorate the condition of the ryot. We also wish to add that the valuation of the land and their probable income can also be done in terms of the common commodities of the regions concerned. We are fully alive to the fact that this method will bring in more complications in respect of the proper assessment of the grade and class of the material tendered, their storage, and disposal, and will mean the transference of the risk involved in the price fluctuations to the primary banks creating a feeling of insecurity in the minds of debenture holders. We feel sure however that with the joint efforts of competent financiers, actuaries and members of Co-operative and Agricultural Departments, a way could be found to solve these problems to the best satisfaction of all concerned. The Government of the United States of America have recently outlined a scheme of crop insurance against drought and other causes of failure. The most fascinating point in that scheme is that the premia will be collected in kind and stored in Government warehouses as reserves against lean years. A measure somewhat on those lines can be thought of. We may state that the idea is not novel as such grain banks were in existence in Italy, and Spain a few decades ago.

Incidentally it may be pointed out that at the Conference of Land Mortgage Banks of Madras held in last October, a resolution was passed to the effect that sale societies are to be established at the head quarters of primary banks. These societies if organised will prove quite handy for the disposal of the produce stored in the warehouses that will have to be constructed according to the proposed scheme. The new system of payment of loans in kind and storing them will also produce a wholesome effect in the market by steadying and bettering the prices of these commodities. It may further be utilised for the spread of the Departmental strains by insisting on the members to pay the instalments with the produce of specified strains.

A COW BUG (*ANCHON PILOSUM*, WLK.) INJURIOUS TO LEGUMINOUS CROPS IN MALABAR *

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Though insects of the bug family *Membracidae*, known popularly by such names as tree hoppers, cowbugs, hornbugs, little devils, etc. are found distributed all over the tropics, hardly any one of them has so far been noted as a plant pest of any appreciable economic importance. Neither Lefroy nor Fletcher in their important publications on Indian insects speak of any of these bugs as plant pests in India. They only refer to one insect of this group *Oxyrachis tarandus*, F. which is commonly noted breeding on *Red gram*, *Acacia arabica* and *Cassia* species and which is never found so far to cause any appreciable damage to their host plants.

During his recent entomological studies in South Malabar, the writer came across a species of this family appearing as a sporadic pest and causing appreciable harm to lab-lab, cowpea and allied leguminous plants. It was noted as rather serious on lablab vines for two seasons in succession in 1935 and 1936. Since there is no record of any such injurious insect from S. India so far, and since the insect is quite different from *Oxyrachis tarandus F.*, it is proposed to present this short paper on this insect and on its bionomics noted so far.

Extent and nature of damage. The insects begin to appear in small members first on the Cowpea (*Vigna Catiang*) crop early in July after the first monsoon rains. From this crop the insect transfers its activities to lablab during the autumn months and continues till early summer. The external indication is the existence here and there on the vines of oval gall-like enlargements which, when cut, show a regular series of numerous cigar shaped eggs of the bug thrust by a female insect, which give rise to the early generations of the season. In course of time adults and young bugs are noted perching like small spines or thorns on the vines and shoots, and these suck the plant sap. Apart from the damage done to the vines during the process of egg laying by the female puncturing and irritating the vines, the bugs in their different development stages suck up the plant sap from the tender portions and allow the distal parts to fade and gradually die out as in the case of plant lice attack. In bad infestations numerous young vines are found fading and dried up, and several gall like formations are found on the vines, which easily snap when handled. The insect is found in all its stages resting and feeding on the tender shoots and pods, and when disturbed the adult hops off in its characteristic style only to perch on an adjacent shoot.

* Paper read at the Indian Science Congress, 1937.

The insect and its bionomics. Membracid bugs are easily made out and differentiated from other plant bugs by their small size, and particularly by the peculiar structural variations of the prothorax in them. This part of the body, takes different shapes in these bugs forming a short horn like process on either side and into another distinct posterior process; these structures often take curious bizarre shapes in different species and have gained them the name hornbugs on that account. The membracid noted in this connection has been identified as *Anchon pilosum Wlk.* Of the half a dozen species of *Anchon* noted so far from India, this species *A. pilosum* has a wider distribution having been recorded from N. India, Bombay, Ceylon and S. India. From its face to the tip of the wings it measures 3½ to 6 mm. The posterior pronotal process is long and sharply pointed backwards and extends beyond the posterior end of the body. The lateral processes or horns are short and blunt though distinct. Eyes are very small and the wings project beyond the body which is laterally compressed. Head and pronotrum, brown testaceous in color; grey pilosity formed all over the body, the post process brown but dark at tip.

As stated before, the eggs are laid in groups, each egg being laid in a puncture made into the growing succulent plant tissue; these eggs hatch in 3 or 4 days into active greenish nymphs. These nymphs have gregarious habits and are often found near the adults and the eggs; they are generally fringed with short spines all over the body surface and feed exactly like the adult bugs on the plant sap. They are neither able to hop nor fly like the adults when disturbed; they either crawl away or drop down. In about two weeks' time, during a normal season, one generation of bugs attains maturity. In this way numerous generations are produced under favourable conditions the pest multiplies and the host plants suffer. So far no natural enemies have been noted. On the other hand the activities of the bug are encouraged and helped by ants as in the case of plant lice. Just like plant lice these bugs also throw out a sweet juice very much sought after by ants. The particular ant found closely associated with this insect is a pale honey colored long legged camponotine ant *Plagiolepes J.* known locally as *Sonan*; it is a fairly common ant found in gardens and households all over Malabar and South Kanara districts. Colonies of these visit the nymphs and adult bugs, tickle them and get the honey dew drops; they also convey the nymphs to secure places on the host plant and tend them like cattle—hence known also as *Cowbugs.* The presence of ants on these leguminous plants often indicate the presence of these membracid bugs also and often give us some clue as to the exact whereabouts of these bugs on the plants.

Control measures. Though when neglected these bugs cause appreciable harm, the pest can be easily controlled with proper

prophylactic and remedial measures. In the early stages, if the adults and the egg galls are hand picked and destroyed, the insect may not assume pest form, but if no attention is paid to it in the early stages, both handpicking and contact washes may be employed with success, even when the bugs are found in numbers. This being the first case of a membracid bug which has shown pest propensities in S. India during his thirty years' experience in S. India, the author has thought it may be interesting to present a short account of such an insect and elicit information and suggestions from economic entomologists in other parts of India.

PRELIMINARY STUDIES IN PLANTAINS GROWN IN MADRAS

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Introduction of new varieties cultivated in the different parts of the province was taken up during 1932 at the Agricultural Research Station, Samalkot. The present collection at the station contain most of the important varieties of the Presidency. It was not till that it was possible to put them down on a field scale to study some of their economic characters under normal field conditions. The general trend of variation in plant and bunch characters of some of the varieties was studied during the year, and the data obtained are presented in this paper.

The crop was grown on heavy clay soils with good facilities for irrigation and drainage. Good sword suckers of medium size and of about 3 to 4 months old were planted 10 links apart either way. They were manured at 20 cart loads of cattle manure and 1000 lb. of ammonium sulphate per acre. The fields were irrigated and drained as and when required.

Growth. It may be stated that under Godavari conditions, the crop generally makes its maxium growth during the rainy months of July to November. As the plant puts on more and more leaves, the stem (pseudo stem) gets stouter and stouter and elongated, till all growth practically ceases about two to three weeks before the inflorescence, commonly called the " flower ", emerges.

Detailed measurements of the heights and the internodal lengths of four important varieties are recorded in Table I which is self explanatory.

Leaf Production. Varieties vary in the number of leaves they produce in a newly planted field if suckers of almost the same age and size are planted and accorded identical manurial and cultural treatments (Table I). The variation in their different leaf characters is recorded in table II.

Flowering. The rate of opening of the spathes of the "flower" seems to be also a varietal character though largely influenced by weather conditions. Varieties which generally produce smaller number of hands per bunch as the White Chakkerakeli and Bontha, open at the rate of one spathe per day while those which produce a larger number like Karpura Chakkerakeli open at the rate of two or even three. Opening of the spathes covering the staminate flowers also follows the same sequence. Opening is delayed or sometimes does not happen on cloudy and cool days; but if the following day happens to be sunny, the number that open will be more than usual, compensating for the previous day's poor opening.

Spathes commence to separate themselves from the "Flower" proper from about 4 P. M. and completely open out the flowers by about 10 P. M. ordinarily. Varieties vary to some extent in this respect. The pistillate flowers seem to be receptive by this time. Dehiscence of anthers takes place from 6 to 9 P. M, in *Eumusa* and *Musa textalis*, by almost midnight in Peivazhai, and about 2 to 4 A. M. in the West Indian.

If the staminate group of flowers of a plant, is allowed to remain on the plant itself, it continues the process of opening its spathes one after another, till the whole "Flower", exhausts itself. In certain cases the "Flower" continues to open its spathes even after the fruits at the top of the bunch get ripe, while in others the "Flower" exhausts itself before the fruits on the bunch ripen. By allowing the flower to remain on the plant after all the pistillate flowers are released, there seems to be a slight delay in the maturity of the bunch and disparity in the sizes of fruits of the top and bottom hands of the bunch. In varieties like Karpura Chakkerakeli and Bontha Bathusa, if the "Flower" is allowed to remain on the plant after all the fertile hands are released, they at times produce a set of hands with pistillate flowers alternated by few hands with staminate flowers. This seems to be merely an abnormality which only certain varieties exhibit.

Maturation of the bunch. The time taken by a plantain bunch to mature, i. e. the interval between the date of flowering and commencement of ripening of the bunch on the plant, seems to be a varietal character (vide table III). It is however highly elastic, depending on the season following flowering, and the irrigation facilities accorded to it at that stage. The interval gets reduced by more than a month when bunching takes place in February instead of October, in spite of the existence of normal irrigation facilities, probably because of the prevalence of bright warm long days during the maturation period of the bunch thrown out in February. Restricted irrigation at this stage has been found to hasten maturity. It is interesting to note that it is not always the long duration varieties that take a longer time to mature their bunches. Flat sided fruit varieties in general seem to take a much longer time to mature than

the round fruited ones. It therefore seems more useful to note the date of harvest than that of flowering in manurial or cultural experiments on plantain as we are primarily concerned with the time taken for the maturation of the bunch. If this is done, bunches have to be kept on the plant till one or two fruits ripen, to have accurate data.

Fruit. Varieties vary widely in the number of hands per bunch and in weight per fruit, and they respond within limits to varied conditions of plant growth. Data in table IV give an idea of the characters of the bunch for some of the varieties studied.

Number of fruits per hand seems to be a varietal character and the variation in it is practically negligible under average conditions of growth. But under extreme fertility conditions, the number appreciably increases or decreases. In heavier bunches it is only the first three hands that show considerable increase in the number of fruits per hand with a large coefficient of variability while all the other hands excepting the last one or two represent the modal class. It is also the early formed hands in the bunch that record higher weight per fruit (table V).

Ripening of the fruit. The general trend of ripening and rotting and the loss in weight of the bunch during the process, as observed in April, in a group of White Chakkerakeli and Karpura Chakkerakeli bunches are brought out by the data in table VI. Bunches with one or two ripe fruits while on the plant were harvested for purposes of this study.

Under aerated and cool conditions, a fully mature Karpura Chakkerakeli-bunch takes about four days and a White Chakkerakeli bunch takes about five days to completely ripen (i.e. turning yellow). Rotting commences 2, 3 and 4 days respectively in the two varieties after the fruits turn yellow. It therefore shows how White Chakkerakeli is unsuitable for distant transport and marketing.

The relative times taken by a bunch with hands intact and that cut into hands, for ripening and rotting is brought out in the table VI.

It is clear that ripening and rotting are hastened by about 1 to 1½ days in the case of bunches cut into hands.

Seeding in plantain. Plantain fruiting is generally parthenocarpic in nature. Excepting a few wild seeded varieties, none of the cultivated ones produce seed normally, though some of these are however capable of doing so, if a wild seeded variety is in the neighbourhood.

To determine as to which of the commonly cultivated varieties are good female parents for the evolution of new varieties, elaborate crossing work was taken up using primarily White Chakkerakeli, Karpura Chakkerakeli, Mauritius and Bontha as female parents and *Eumusa*, *Musa textalis*, West Indian and *Sapota arati* (Peivazai) as male parents. Mauritius and the White Chakkerakeli refused to set seed

while the other two did so when crossed with *Eumusa* and *Musa textalis*. In addition West Indian induced seeding in Karpura Chakkerakeli and Sapota Bontha. Neivannan was also found to seed freely as it happened to be in the neighbourhood of *Musa textalis* in flower.

The seeds were sown as per 'Dr. Cheesman's method', but all of them failed to sprout. This may either be due to the incompatibility of the parents or the seed under local conditions may require more resting period. The local "Ginjala arati", however, readily sproued when the seed was sown immediately after the fruit became ripe.

Table No. 1.

Composition of the Pseudo-stem of plantain after bunching.

(Mean of measurements in 10 plants of each variety).

Serial Number.	Variety.	Length of internodes in inches (numbering from the top).										Average total length of the stem up to the junction of the flag leaf.	Average length of stalk of the Bunch.	Average length of bunch proper.	Average number of green leaf bases around the stem at the time of bunching.	Average total number of leaves per plant.
		1	2	3	4	5	6	7	8	9	10					
1	Karpura chekkerkeli	29·3	32·22	19·88	8·90	4·75	3 60	2·04	1·64	1·25	...	99·65	23·78	23·56	20·00	27
2	White chekkerkeli	19·12	26·00	23·57	14·85	7·73	3·70	1·98	1·19	0 98	0·60	98 91	16·50	11·95	16·8	25
3	Bontha	27 01	37·50	23·42	14·40	6·16	39·2	2·08	1·25	0·85	1·40	109·3	32·00	16·20	19·8	29
4	Mauritius	15·00	15·75	10·50	7·00	3·15	1·75	1·15	0·75	0·65	0·45	56·2	...	20·00	16·0	25

Table II.

Some of the leaf characters in Plantain.

(Average of 10 plants in each variety.)

	Karpura Chekkerkeli.				White Chekkerkeli.				Bontha.				Mauritius.			
	Length in inches of				Length in inches of				Length in inches of				Length in inches of			
Leaf No. from the flag leaf down.	Leaf base.	Leaf Stalk.	Length of Lamina.	Width of Lamina.	Leaf base.	Leaf Stalk.	Length of Lamina.	Width of Lamina.	Leaf base.	Leaf Stalk.	Length of Lamina.	Width of Lamina.	Leaf base.	Leaf Stalk.	Length of Lamina.	Width of Lamina.
1	23·9	...	31·3	17 0	14·6	...	45·0	24·0	18·5	...	9·4	19 0	28·0	...	8 0	5·5
2	51·0	10 8	71·3	26·5	44·8	4·5	39·9	...	46 9	10·1	57·2	23 8	37·7	3·5	44·5	22·0
3	78·4	14·5	80·6	30·1	67·3	6·19	77·3	25 2	74·4	13·8	75·2	25·3	45·3	3·5	57·0	28·0
4	93·9	15·0	82·2	29·4	82·7	8·6	84·2	26·2	86·7	14·4	76·0	25·3	52·4	2·0	61·0	28 5
5	98·2	16·4	82·6	30·4	87·3	10·7	83·0	25·5	97·1	16·1	75·3	25·1	51·7	6·9	63·0	26·5
6	98·5	14·6	79·0	30·5	89 3	9·3	77·7	26·7	97·6	16·5	73·4	25·4	54·0	4·5	47·0	26·5
7	94·9	16·5	76·4	29·5	86·9	9·3	82·1	27·5	95·2	16 6	73 1	25·3	53·3	3·3	56·5	27·0
8	92·6	14·3	...	28 8	83·9	9·1	77·0	29 0	92·1	15 4	70·2	25·5	52·8	3·5	51·0	25·0
9	90·6	16·1	73·3	28·7	80·1	9 0	72·1	27·3	89·3	15·0	71·2	25·5	56·4	2·5	55·5	2[illegible]·0
10	85·5	14·2	74·0	28·3	78·6	8·30	69·7	27·3	...	11·8	73 8	23 5	46·0	5·5	51·5	25·0
11	78·6	12·4	67·1	26·3	73·6	...	67·0	27·0	88·0	12 0	...	...	49·7	5·3	51·0	24·0
12	74·6	11 4	60·3	26 9	74·6	8·00	56 0	...	79·0	...	...	...	...	...	...	...
13	68 4	10·2	51·9	24·0	...	...	...	...	...	...	...	...	...	...	...	...

Table III.

Time taken by the different varieties to bunch and mature their bunches and the effect of season on the maturation period.

Serial number.	Variety.	No. of plant examined.	Months taken to bunch. January planting	Months taken to bunch. June planting	Days taken to mature the bunch. Month of flowering. October Fortnight. I	October Fortnight. II	November Fortnight. I	November Fortnight. II	December Fortnight. I	December Fortnight. II	January Fortnight. I	January Fortnight. II	February Fortnight. I	February Fortnight. II	March Fortnight. I	March Fortnight. II
1	White Chekkerkeli ...	180	10½	8	...	...	115·0	106·4	103·5	97·9	94·0	88·5	85·0	82·0	78·3	...
2	Karpura Chekkerkeli ...	280	11	8½	129·8	127·6	124·2	123·4	116·9	114·5	113·0	102·3	98·0	96·5	...	...
3	Mauritius	40	9½	6½	124·4	125·9	124·8	126·0	...	109·3	110·3	113·5	...	...	...	...
4	Bontha	40	10	8	...	136·4	137·4	132·6	128·0	118·0	113·1	114·0	...	...	...	...
5	Kadali	12	13	...	...	...	...	...	...	...	...	...	...	89·5	...	...
6	Vadakkan Kadali ...	...	11½	10½	...	...	...	132·5	...	111·5	...	...	...	...	...	...
7	Nendran	...	...	8	...	...	...	...	...	106·0	101·7	99·0	...	...	...	...
8	Kommu Arati	...	10½	8	123·0	121·0	112·7	108·0	...	...	...	...	...	...	...	...
9	Namarai	...	9	...	129·0	...	...	...	...	...	...	...	...	...	...	...
10	Sudha	...	10	8	135·0	130·0	128·7	130·8	...	...	...	106·0	...	...	...	...
11	Chingan	...	9	...	143·0	136·0	...	...	...	...	...	...	...	...	...	...
12	Kunnan long	...	11½	...	...	...	...	...	...	...	124·0	...	...	...	...	...
13	Amrutapam	...	12	...	...	...	...	...	...	...	125·0	...	...	...	...	...
14	Nadan	...	9½	...	159·5	155·5	...	...	...	...	...	...	...	...	...	...
15	West Indian	...	10½	7½	...	...	...	144·0	138·0	...	129·5	...	...	...	...	...
16	Kapur bale	...	10	7½	...	154·0	...	150·0	143·0	...	141·0	...	...	...	...	...
17	Vannan ordinary ...	...	10	...	...	...	150·0	...	...	...	...	...	...	...	...	...
18	Eradan	...	9	...	168·7	169·5	...	...	...	...	...	...	...	...	...	...
19	Kundarai Valan	...	9	7	...	171·7	...	...	...	...	...	...	...	...	...	...
20	Nei Vannan	...	11	...	...	...	..	141·9	143·0	...	136·5	130·0	...	...	...	...
21	Sirumalai	...	9	7	173·5	174·0	...	...	144·0	138·0	124·0	...	...	...	...	...
22	Yenuga Arati	...	9	7	167·0	168·0	...	...	156·0	143·0	141·0	...	...	...	...	...
23	Vannan Eradan	...	...	8	...	...	...	...	...	142·5	129·0	...	...	...	...	...
24	Boothi bale	...	...	11½	...	...	...	...	...	...	...	...	...	...	...	...

Table IV.

Characters of the bunches.

Serial No.	Variety.	No. of bunches exa-mined.	No. of hands per bunch.	No. of fruits per hand.		% of stalk to gross Wt. of bunch at the ripe stage.**	% of pulp to fruit at the ripe stage.	Av. Wt. per fruit (in Ozs.)
				Mode.	Mean.			
1	Karpura Chakkarakeli	12	9-13	16	16·46	8·5	81·10	2·83
2	Sudha	2-5	9-11	16	15·43	9·7	78·00	2·96
3	Vadakkan kadali	...	12-13	16	16·58	...	86·70	2·28
4	Kunnan round	...	8-10	16	16·40	...	...	...
5	Kadali	...	7—8	16	16·52	7·9	87·80	2·40
6	Surya Kadali	...	5—6	16	17·40	10·6	86·00	2·11
7	Namarai	...	5—7	16	15·60	...	70·10	1·10
8	Kunnan long	...	6—8	14	13·87	9·3	...	...
9	Mauritius	...	8—9	14	14·50	6·1	75·40	3·99
10	Yenuga arati	...	8—9	14	13·80	14·7	72·10	3·30
11	Siru malai	...	7—8	14	13·79	16·9	68·00	3·36
12	Eradan	...	7—8	14	13·80	12·30	72·00	3·15
13	Kudarai--Valan	...	7—8	14	14·00	14·1	79·90	3·35
14	Neivannan	...	8—9	14	14·10	10·5	68·60	4·65
15	Nadan	...	7—8	14	13·80	7·9	69·50	4·57
16	West Indian	...	7—8	14	14·00	9·6	73·63	3·33
17	Kapur bale	...	7—8	14	14·00	10·7	69·80	4·67
18	Vannan eradan	...	7—8	14	...	...	77·50	2·44
19	White Chakkarakeli	13	4—5	12	12·71	10·9	67·70	4·43
20	Kommarati	2-5	4—6	12	12·92	10·5	69·65	3·30
21	Chingan	...	6—7	12	12·45	...	77·70	3·78
22	Bontha	14	4—6	12	11·42	8·1	71·40	7·83
23	Bontha Batheesa	...	10-15	12	11·75	...	...	...
24	Nendran	...	4—6	10	9·10	10·7	69·30	7·75
25	Anaikomban	...	6—8	...	...	5·2	75·80	5·64
26	Nalla Chakkerakeli	...	4—5	...	...	5·4	76·30	4·85
27	Bendarati	...	...	...	...	16·1	73·50	1·95
28	Sapota Bontha	...	...	...	...	14·5	...	2·10
29	Amruta Pani	...	6—8	...	...	7·5	...	5·70
30	Airamka Poovan	...	40-45	12	...	8·0	84·90*	2·66*

* Based on the data of fruits in the top 25 hands.

** Stalk cut 18 inches above the top hand.

Table V.

Variation in the number and weight of fruits. Variety—Karpura Chekkerakeli.

(Mean 16·46; Mode 16.)

Serial number of hand from the base.	Mean number of fruits. No. of hands in the bunch.					C. V. in the number of fruits. No. of hands in the bunch.					Wt. per fruit as a % of mean. Wt. per fruit of the bunch. No. of hands in the bunch.			Remarks.
	9	10	11	12	13	9	10	11	12	13	11	12	13	
1	16·57	19·57	19·94	18·70	17·56	23·78	21·67	20·71	23·84	19·41	109·3	106·6	124·8	
2	17·14	18·75	19·79	20·37	20·11	18·38	17·71	20·00	18·70	21·28	112·3	113·7	116·2	
3	15·52	16·26	16·56	16·85	18·22	4·63	11·93	10·75	11·10	16·74	113·8	117·5	119·4	
4	15·52	15·87	16·34	16·66	16·56	4·63	4·60	5·32	5·22	3·32	111·2	109·6	117·0	
5	15·05	15·95	16·29	16·41	16·00	6·70	4·64	5·03	4·93	2·94	104·5	108·7	109·8	
6	15·00	15·60	15·80	16·43	16·11	6·76	5·51	5·44	5·84	3·41	104·6	112·8	107·7	
7	14·91	15·54	15·72	16·07	16·00	7·71	5·46	5·66	3·73	...	96·7	97·5	96·8	
8	15·10	15·76	16·03	16·25	16·12	11·19	5·52	5·57	5·53	2·33	91·1	95·1	97·5	
9	13·80	15·76	16·15	16·18	16·22	15·50	5·59	6·50	6·18	2·53	90·0	94·4	89·3	
10	...	14·58	15·70	16·20	15·59	...	13·30	7·08	7·22	3·54	79·9	82·9	84·7	
11	...	...	13·75	16·27	15·99	...	...	16·70	6·27	11·19	65·1	72·4	79·4	
12	...	...	...	13·09	15·89	...	...	...	17·79	10·00	...	54·6	61·1	
13	...	...	...	...	12·44	...	...	...	...	23·95	...	...	53·9	
No. of bunches examined.	21	64	95	84	9									
Per bunch.	15·34	16·57	16·63	16·60	16·42	14·73	15·41	16·12	17·11	16·44	100·0	100·0	100·0	

Table VI.

Progress of ripening and rotting in bunches kept in tact and cut into hands.

(The fruits were kept hung up in shade).

No. of days after harvest.	Hands not separated from the bunch.						Hands separated from the bunch.						Remarks.
	% of fruit that have ripened.		% of fruit that have commenced to rot.		Wt. of the bunch as a % of its weight at harvest.		% of fruits that that have ripened.		% of fruits that have commenced to rot.		Wt. of the hands as a % of their weight at harvest.		
	W. Ch.*	K. Ch.*	W. Ch.	K. Ch.	W. Ch.	K. Ch.	W. Ch.	K. Ch.	W. Ch.	K. Ch.	W. Ch.	K. Ch.	
0	0·0	0·0	...	...	100·0	100·0	0·0	0 0	...	...	100 0	100·0	* W. Ch. = White
1	4·4	9·1	...	...	95·5	95·6	1·2	3·9	...	...	94·1	94 9	Chekkerakeli.
2	9·5	37·4	...	...	93·3	93·1	10·0	23 4	0·9	0·5	90·9	93 7	
3	31·7	81·3	...	...	90 2	89 5	43·9	53·7	2·6	0.5	84·8	90·3	* K. Ch. = Karpura
4	68·3	98·4	0·9	0·8	86·2	87·1	100·0	100·0	6·3	4·4	84·1	86·3	Chekkerakeli.
5	94·0	100 0	23·3	2·2	83·3	83·9	...	...	44·1	27·4	81·6	83·3	
6	100·0	...	44 0	11·1	77 1	82·0	...	...	100·0	61·5	78·1	79·3	
7	...	...	68·2	42·1	74·1	...	...	...	...	100·0	74·6	...	
8	...	...	95·6	100	...	...	...	...	...	...	...	...	
9	...	...	100·0	...	...	...	...	...	...	...	...	...	

NOTES ON THE INCIDENCE OF THE SWARMING CATERPILLAR OF PADDY

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Introduction. *Spodoptera mauritia*, the swarming caterpillar or the army worm of paddy is long known to be one of the worst insect pests of young paddy in South India. The insect appears in such vast numbers, that it devastates field after field of young growing paddy in incredibly short intervals, marching over fields in regular swarms. In ordinary circumstances, this insect in pest form is known only by the damage done to the crop in large areas simultaneously. The pest usually occurs in crops sown broadcast or in wet nursery. Visible damage is done only when it is in the fairly grown up caterpillar stage and since the pest appears sporadically all over a large tract, its presence is known, and control measures attempted in most cases, only when the caterpillar has finished almost its career of destruction of crop.

It is known that the life cycle is completed in the course of 40 to 50 days, and that under certain conditions the period may be as low as 28 to 30 days. The parent moth lays its eggs in masses on the host plant. The eggs hatch in about 3 to 5 days and the larvae begin to feed. The larval period lasts for about 3 to 5 weeks and the full grown larvae pupate in the soil. In about 10 days adult moths come out. These moths again find out suitable food plants for further infestation, and breeding. The most important point is the insect's instinctive powers to reach suitable breeding places during different parts of the year, and selecting cultivated crops only occasionally.

Distribution of the Pest. In the Madras Presidency, the occurrence of the pest is reported every year in some part or other. In South Malabar, the earliest sown first crop is sometimes subject in May to severe attacks often necessitating a resowing. The insect is found in abundance on hill grasses during October-November, in North Malabar and elsewhere during some years. It is very conspicuous regularly every year during January and February, often in pest scale, in the summer crop grown in the Kole areas of Malabar. Our observations during the past two years have shown that the insect is found even during the other parts of the year, in small numbers in several places at Coimbatore and parts of Malabar and it is thus evident that the insect is present almost throughout the year

in paddy growing areas, ready to appear in pest form under favourable conditions of weather and crop.

Incidence of the Pest. The first condition for the appearance of the pest is the existence of the suitable stage of the crop. The moth generally lays its eggs on tender paddy and only rarely it visits crops over 20 days old for egglaying. In the course of observations made in the Kole area in Malabar, it has been observed that the moth appears almost immediately after sowing, and start laying eggs when the plants just put forth the needle-like small white shoots. The eggs are laid piece-meal, 15 to 20 in a mass on each plant covering the white shoot, the stem or even the seed itself, unlike in the laboratory where they are found in bigger masses, invariably exceeding 100 in number. The preference shown by the moths to lay their eggs on tender paddy shoots is seen even under laboratory conditions when paddy seedlings of different ages and grasses on which the larvae are known to feed are supplied simultaneously. Apart from the existence of suitable stage of crop for food supply, there appears to be also many other factors influencing the severity of attack under field conditions.

The Conditions of Soil and other Physical Factors. Taking into consideration the infestation in cultivated crop of paddy, there are mainly two periods of outbreaks—one during May in the tracts where usually 'dry sowing' is the rule, and another during January—February in the Kole paddy where 'sowing in puddle' is the practice. While in the former case severe infestations are less frequent and less widespread, in the latter case the infestation is more or less a regular feature every year on a smaller or larger scale. In both these cases, the circumstances which favour the incidence appear to be more or less the same.

From our observations of the pest in the 'dry sowing' areas, it would appear that the pest outbreaks are not of annual occurrence. In some years the first summer rains come in heavy downpours and the fields are flooded. When a dry spell intervenes the water in the fields dries up, or is drained away for facilitating the sowing operations. Army of caterpillars appear in such areas and spread rapidly to all plots in the neighbourhood. The infestation generally stops with the single brood, though sowing is protracted over a longer period and a second crop is also raised during monsoon in the same locality. The occurrence of a host of moths to start a heavy infestation just in time the first crop is started, is a remarkable feature. All that one can perceive, is that a striking change in the atmospheric conditions has been brought about by the first heavy downpour after a long spell of continuous hot weather and the almost immediate exposure of the flooded areas to the hot sun. It would appear that the moths either enlivened from their summer stupour or stimulated to a stronger impulse of breeding activity by the abrupt change in

weather, precociously reach such areas either through tracing the smell emanating from the newly wetted and fast drying soil or rather drifting along the moisture currents that are now set up in the air. The original foci of infestation are invariably lowlying flooded fields from which the growing larvae march in all convenient directions.

The habits of the moths and their occurrence in relation to soil conditions and weather in a typical Kole area in Malabar, viz., the Enamakkal lake, have been studied in greater detail during two successive seasons. The whole lake is first drained off and the seeds are sown in puddle. The soil is soon exposed to the action of the sun. The moths appear soon from the far away hilly tracts in the North and North East. The following characteristic features seem to announce the arrival of moths to the area (1) reduction in the velocity of the winds and their gradual cessation followed by a period of calm and then a change in the direction, (2) hot and sunny weather during day, and humid and sultry condition during nights with cloudy sky, and (3) absence of any continuous and strong breeze. The moths are active during nights only. Now with the change in the atmospheric condition and with the sudden exposure of the soil surface, air movements are initiated. These link the rising mass of air of this region with that of the hill region farther off. Owing to the natural tendency of the moths to move to the region of greater comfort the winged ones get along a more or less continuous belt of moisture laden atmosphere, against the current. Having reached the area, the natural instincts of the moths come into play in the matter of selection of suitable habitat for egglaying. In fields where the water dries up completely and the soil surface cracks, the egg-masses are rare, while in adjacent lowlying fields where the soil is swampy and the seedlings are more succulent, the moths gather more often for laying eggs.

It is a common experience that though the moths appear all on a sudden in swarms they halt and lay eggs only in certain fields. On close observation it has been noted that they appear in successive batches in the locality whenever the ideal conditions for their egg-laying are prevalent. The most surprising phenomenon is the appearance of broods of adult insects in quick succession though no pupal or larval stages of the insect are noted in the near vicinity. During the year 1935, within an interval of about one month, no less than five batches of moths appeared, and in 1936, during the same period, four such intermittent arrivals were traced in the same locality at very short intervals. It was also noted that when the conditions of weather changed almost all the late sowings in the very same locality escaped fresh egglayings though moths could be had in numbers due to the emergences from the earliest brood completing their life cycle. A second infestation in the same crop and place did not take place owing to the aging of crop and to the change in the atmospheric

conditions. The larvae completed their life cycle in one locality and the emerging moths marched out instinctively to distant situations suitable for further breeding. From the data so far collected it appears that they are more directed by the prevailing moisture conditions of the atmosphere and the nature of the air movements than anything else. The appearance of large numbers of caterpillars in an area all on a sudden is brought about by the early arrival of a large number of moths to the area during the early stage of the crop.

The Moths' egglaying activities. Soon after dusk the moths move out of their temporary shelters and distribute themselves over large areas for laying eggs on suitable plants, and hide before morning and remain at rest during the day under cover of dry leaves and cracks in the soil, thatches or other material in the vicinity of plants and bunds. The egglaying in any one field or fields is completed in the course of three to five days and ordinarily no further egglaying takes place in the locality, unless in rare cases, by the recurrence of the same soil conditions, fresh brood of moths is attracted to the same plots before the crop is about 3 weeks old. During the period of moth abundance, it has been possible to see the moths active in flying and laying eggs in different portions of the field during nights. One can easily see the moths disturbed from their resting places, while walking slowly through the fields with a 200 candle power light an hour after dusk. The moths take to flight from a distance at the approach of the light and dart with great speed in different directions. The moths in actual egglaying are, however, not so easily disturbed. During January last, based on previous year's observations, probable affected plots were located and the moths were looked for on certain days as prevísaged by the prevailing weather conditions; and this proved the first recorded instance of the operation of egglaying by this moth in the field on a large scale, having been observed. It is interesting to note that in fields of suitable conditions for laying eggs if the soil conditions appear too swampy for the moths to wade in their efforts to lay eggs piecemeal over several tender plants, they have been found to congregate in small numbers on twigs of plants casually planted on the bunds and on these eggs are laid in very large masses. The newly hatching larvae drop down by means of their silken threads right over the growing seedlings to disperse themselves later on to other plants all round. This observation is suggestive of a further and novel means of destruction of large numbers of moths and eggmasses in a collected form. During the last season, in this manner, no less than 60 to 70 large sized eggmasses were collected and destroyed from each plant twig employed for the purpose.

Summary and Conclusion. From a detailed study of the incidence of the pest (*Spodoptera mauritia*) at the Kole and other areas, it is noticed that the infestation always takes place in newly sown crop and

in plots where there has been no crop previous for a fairly long period. In such cases moths appear all on a sudden, probably attracted by young crop combined with favourable changes in the micro-climate of the locality in question. If the area is sufficiently large and if the sowing is in progress for a longer interval with repetitions of conditions of high humidity and hot sunny whether, successive batches of moths arrive in the locality and all the sowings are serially infested. As a rule, larvae are all of the same age in the same plot or plots and the moths arising out of these larvae do not infest the same crop again. The moths march far before they find suitable material for continuing their brood. In this endeavour, they seem to be guided mostly by certain conditions of weather. In most cases it is fruitless to watch for a second generation in the same crop, as the conditions under which the moths first appear change entirely by the time they complete one life cycle. The actual shifting of the breeding place from one centre to another is guided partly by the insects' instinctive powers and partly by the atmospheric movements. The moths appear to move from one region to another against a drifting current of moisture laden air.

The moth seems to be present even in localities where it is not known to be a serious pest for years together. It is only the paddy crop sown in puddle before the break of the regular monsoon that is likely to suffer. Here again the moths prefer to infest the crop in fields where the swampy conditions of soil persist for a longer period. If on the other hand, the soil dries up quickly and water is let into the fields only after an interval of about 15 to 20 days without any further chance of the land drying up, the infestation is fairly thwarted. A dry sown nursery and the transplanted crop are least attacked. In places of annual recurrence of the pest, resort to transplanting instead of sowing in puddle minimises injury to a great extent. The habit of the moths to lay eggs in masses on twigs planted for trapping offers another easy means of control.

The study so far made is by no means complete. The conditions favourable for their development in plants other than cultivated paddy have to be thoroughly examined, and a climograph showing favourable places for their successful breeding during different parts of the year have to be prepared. Information on such lines will naturally lead us to a better understanding of the causes leading to the moths' sudden invasions to cultivated crops. Observation on this pest are also likely to help us considerably in tackling other allied insects like cutworms in general such as Agrotis, Prodenia, Laphygma, Chloridea, etc., which appear sporadically as severe outbreaks among cultivated crops and which seem to respond to changes in weather in much the same way as the swarming caterpillar of paddy.

Research Notes.

Seedling Abnormalities in Cotton.

In the course of recording routine observations on cotton seedlings raised at the Agricultural Research Station, Nandyal, the authors have come across during this season a few cases of morphological abnormalities. As these are of botanical interest and do not seem to have been recorded before, a brief account of them is presented in this note.

The abnormalities observed relate to variation in structure, attachment and number of the cotyledons. They are of four different types.

Case I. A single rotund cotyledon was observed on the top of the hypocotyl, the attachment resembling the peltate condition of the lotus leaf. The fringe was raised all round resulting in a basin like structure. The part of the axis immediately below the attachment was slightly swollen. These were observed in two seedlings of G. Indicum. Ten days after sowing the plants did not make any further growth and remained in that condition for about a month when the normal plants attained 6 or 9 inches in height. In one seedling a small sprout appeared from the bulged portion below the attachment. Attempts to induce further growth in the seedlings by special attention proved futile, and as the cotyledons showed signs of drying up the seedlings were pulled out and preserved in formalin.

Case II. In an Indicum seedling two cotyledons and the radicle were all the development observed ten days after sowing. The plumule was entirely absent. Failure to grow was not due to insect injury. There was also no mark to indicate that the plumular bud was arrested in growth. It was believed that this defect is congenital and not developmental. The seedlings remained stunted for another week when signs of wilting necessitated pulling it out for preserving in formalin. The cotyledons were thick, succulent, brittle and broader than normal.

Case III was a Cambodia (Co. 2) seedling in which the cotyledons were found fused together from the bases of their stalks to form a sort of open sheath surrounding the stem. The fused cotyledon was shifted to a side. large in size and fan-shaped in out-line. The terminal bud was replaced by a few short branches bearing minute leaves. The plant withered away soon.

Case IV. This was a strange freak in Cambodia seedling where three leaf-like structures with distinct stalks appeared in the cotyledonary node. While two of these had the normal shape the third was smaller in size elliptic-truncate in out-line. The extra growth seemed to be a meristic variation. It is learnt that a similar type of abnormality was once observed in Cambodia by the cotton specialist, Coimbatore and more recently in two plants of *herbaceum* cottons. Seeds from these plants were reported to have given rise to normal plants only. It may be mentioned that Cases I, II and IV are comparitively rare.

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A field mite as a household pest in South India.*

As far as the writer is aware there does not occur any previous record of any field mite appearing as a household pest in S. India. Of course there are mites very well known as skin parasites of men and domestic animals like cattle, dogs and birds found all over the world, but the present case appears to be one where what is apparently a field mite was noted to appear in swarms in a house and cause considerable inconvenience to the inmates of the same. In July 1936, the

* Paper read at the Indian Science Congress, 1937.

upper rooms in a new house in R. S. Puram, Coimbatore, were found infested by swarms of a mite crawling along the floor, the walls and even the bedsteads and clothings in them. It was during the night time that these were found more numerous and very active. At night they were even noted crawling over the bodies of sleeping persons and causing very great annoyance. Curiously enough these creatures were not noted to cause anything more than mere mechanical annoyance by crawling over the bodies of persons; they did not prick the skin or cause any irritation or itchings like parasitic mites. Although they were not such, yet the annoyance was sufficient enough to drive the inmates from those rooms.

Attempts to find out what they feed on were not successful. The mites increased to such numbers in the house that the inmates had to vacate the whole wing of these infested rooms for a week and sleep elsewhere. The rooms were fit for occupation only after they were thoroughly washed with crude oil emulsion or phenyle. After an interval of a few months the pest again appeared in the same house though not on such a serious scale as on the first instance. The creatures are very tiny specks of life like very small spiders a greenish brown colour and the adults measure less than a fourth of an inch. It appears as though it was an abnormal migration of the creature from some natural habitat, but attempts to find out the place from where these first came into the house have not so far been successful. The idea of this paper is simply to record such an occurrence not previously known in S. India. As far as the writer can make out the mite appears to belong to the family Tetranychidae in which are included most of the plant feeding forms known as "red spiders" brown mites etc.

The occasional invasion of dwellings by the clover mite (Bryobia pratensis G.) has been recorded from the U. S. A., by Miller and in Canada by Gibson and Twinn, but a comparison of the description of the clover mite with the subject of this paper shows that the two do not belong to the same species. It will be interesting to quote Miller's remarks on the peculiar house infesting habit of the clover mite as :

"A habit peculiar to the species is that of entering buildings during the fall. The exact prompting of this migration is still to be determined although heat probably plays a major role. Nymphs and adults will swarm into houses, spend the entire winter there and in the spring pass to the outside. I have observed this on several occasions. There was no food supply in the form of green plants available yet thousands of the mites remained alive throughout the winter of 1923 in a cold basement room."

The exact identity and systematic position of the mite is being studied and it is hoped to record these facts in a future contribution.

Ref. (1) Miller A. E. "An introductory study of the Acarina or mites of Ohio."
(2) A. Gibson. "*Household insects and their control*" and C. R. Twinn, Book No. 112 new series, pp. 73, Dept. Agr. Ottawa.

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ABSTRACTS

An Improved Cotton Picker. A much improved, more efficient cotton picker has been recently invented by Rust and Rust in America. It is reported to be capable of doing the work of a hundred pickers.

The new machine strips cotton even from the unopened bolls of the cotton plant It has also a 'Mechanical gleaner' on it which salvages any dropped cotton. It is more compact so that it can get between narrow rows of cotton plants. (*Science Supplement*, Vol. 84 No. 2186). V. R.

Prevents Plant Growth on Masonry. According to a Swiss inventor, H. Zimmerli, the growth of plants on walls of masonry can be controlled by adding to the mortar—for example, in case of water reservoirs, beach walls, and the like--substances that prevent the germination and growth of plants. In particular good results are obtained with the addition of three parts of sodium chlorate and two parts of iron sulphate to 100 parts of quartz, sand and mortar. It is especially recommended that some sodium fluoride or colloidal silver also be added. Finally, the hardened plaster is sprayed with a dilute emulsion consisting of boiled linseed oil, wood grease, ground fluorspar, ammonia, and 2 per cent. copper sulphate. This treatment is claimed to be very effective.—(Scientific American, April 1936). (*The Indian Forester*, Vol. LXII, No. 10). K. M. T.

Milk production costs at the Agricultural Research Institute of Northern Ireland by Hale. (*The Journal of Ministry of Agriculture*, Vol. 43, pp. 768).

The prime costs are not comparable with other costing results frequently presented. No value is put on new born calves and no attempt is made to debit various departments of the farm with proportions of overhead costs and rent. Hence the costs will have to be used with caution if they are to be compared with returns. The information contained in the table gives the reasonably accurate direct costs of milk production under practical farming conditions and gives us an idea of the variations the item may be subject to under vicissitudes of farming.

Average prime costs per gallon of milk produced in pence.

	1928–29 d	29–30 d.	30–31 d.	31–32 d.	32–33 d.	33–34 d.	34–35 d	35–36 d.
Depreciation of cows	2·92	0·82	1·60	1·70	1·43	1·46	2·02	1 25
Depreciation and keep of bulls	0·97	0·49	0·34	0·31	0·38	1 41	0 58	0·43
Wages and horse labour	2·91	2·51	2·26	2·00	1·92	1·87	1 98	1·81
Concentrate	4·04	4·58	3·64	3 51	1·94	1·96	2·20	2 20
Coarse fodder	2 54	2·10	1 79	2·27	2 07	2·79	2·24	1·83
Grazing	0·20	0·13	0·91	0·19	0·27	0·28	0·33	0 23
Tuberculin tests	0 70	0·26	0 27	0·27	0·31	0 27	0 30	0·04
Sundries	0·85	0·88	1·21	0·67	0·77	0 65	0·71	0·71
Dairy costs	2·60	1·77	2·15	1·79	2 05	1·85	1·76	1·55
	17 73	13 54	13·45	12·71	11·14	11·54	12·12	10·05
Average No. of gallons of milk per cow	798	798	814	764	624	656	703	729
Lb. of concentrate fed per gallon of milk	3 36	4·27	4·11	4·66	2·74	3·02	3·17	3 33
Average price of concentrates per cwt. £	0–11–2	0–10–0	0–8–3	0–7–0	0–6–7	0–6–1	0–6–6	0–6–2

N. B.—Prime costs do not include rent and overhead charges.

R. B.

Agricultural Jottings

BY THE DEPARTMENT OF AGRICULTURE, MADRAS

Agricultural Marketing. The marketing section has been engaged in the survey of many agricultural commodities of importance. Marketing survey reports of the following commodities have been completed and forwarded to the Agricultural Marketing Adviser to the Government of India :

Rice	Coffee	Eggs
Wheat	Tobacco	Hides and skins
Groundnut	Cattle	Plantains
Linseed	Milk	Grapes
		Pineapples.

The reports contain relevant information on all points relating to marketing of the commodities such as supply, demand, prices, preparation for market, assembling, transport and distribution of profits among several agencies of the trade etc. Such reports from all the Provinces and Indian States will be compiled and published by the Agricultural Marketing Adviser to the Government of India.

As a next step in the work of the marketing section, developmental activities on some of the crops for which surveys have been completed have just been taken on hand. A conference of growers, manufacturers and exporters of cigarette tobacco was held at Guntur with a view to arrive at the greatest common measure of agreement among all interests concerned in the export trade of cigarette tobacco. The district of Guntur occupies a prominent place in the cultivation of Virginia tobacco growing as it does about 40,000 acres which is more than 95% of the total area in India. Besides, it grows a considerable area ranging from 50,000 to 60,000 acres under country brown tobacco suitable for cheap cigarettes, beedies, and pipe and shag On the unanimous agreement of all interests present at the Conference, it was resolved to form an association at Guntur to standardise grades and packages for export, and thereby improve the reputation of Indian tobacco abroad. The rules and regulations have been framed for this association, somewhat on the lines of the East India Cotton Association. The object of the association is essentially to bring more money into the pockets of the primary producer.

The preliminary requisite for any programme of organised sale of ryots' produce has to come largely from the growers. For this purpose, the creation of healthy organisations of producers is a first step. Further more, success is more possible of achievement with special purpose organisations for each commodity as tobacco, fruits etc. In order to achieve this object, the marketing section has been investigating the possibilities of such work in the primary producing areas as Cuddapah district for oranges and melons, Vizagapatam district for mangoes and Trichinopoly and Madura districts for plantains. In a recent Government Order the Government have also provided for the creation of a post of Assistant Marketing Officer, specially to help in the developmental activities of marketing work from January 1937. A Provincial Marketing Society has also been formed in Madras with a view to co-ordinate the work of several loan and sale societies, and to find a market for surplus produce like fruits, jaggery, ghee, potatoes etc., in the Madras City.

Proposals were made by the marketing section even at the beginning for the publication of prices of the commercial crops in a form useful to the trade. It was suggested that, for such information to be useful, it was necessary that wholesale prices of crops with specification of quality and trade name, ought to be published for all important markets for such commodities as paddy, rice, tobacco, jaggery etc. In a recent Government Order, the Government have ordered that from January 1937 these prices would be published each Tuesday in the Fort St. George Gazette and English and Vernacular papers issuing from Madras. The prices reported will be the wholesale prices ruling in different market centres of the presidency on Monday each week. of the several commodities The prices will be published in terms of one common unit, viz., the Imperial maund of 82-2/7 lbs. The retail prices of the several commodities at the important market centres will also be published. The agency for such work will be the statistical section formerly attached to the Board of Revenue, and now under the Director of Industries.

It is not possible to render into the small space available in our dailies the extensive data collected by the marketing staff, but it is proposed periodically to give short marketing notes on important commodities like rice, groundnut, coconut, coffee, fruits, milk etc, in the succeeding issues for the benefit of the public.

Crop & Trade Reports.

Paddy—1936-37—Intermediate Report. The main crop of paddy has been or is being harvested in parts of the Circars, Kurnool, Nellore, Coimbatore, Madura and the West Coast. The yield is reported to be normal in Vizagapatam, Kurnool, Coimbatore, Madura and the West Coast and below normal in the other districts.

In parts of the Chingleput district, the crop has been affected by drought to some extent, while in parts of the Salem district, the crop is reported to have suffered a little from attack by insects. The condition of the crop is reported to be generally satisfactory in the other important paddy growing districts.

The wholesale price of paddy per imperial maund of 82-2/7 lbs. as reported from important markets towards the close of December 1936 was Rs. 2—13—0 in Cuddapah, Rs. 2—11—0 in Nellore and Salem, Rs. 2-8-0 in Vizianagaram, Nandyal and Madura, Rs. 2--6—0 in Vellore and Erode, Rs. 2—4—0 in Guntur, Rs. 2—3—0 in Rajahmundry, Ellore, Bezwada and Masulipatam, Rs. 2—1—0 in Cocanada and Trichinopoly and Rs. 1—13—0 in Kumbakonam. As compared with the prices reported for November 1936 the prices are stationary in Rajahmundry, Cuddapah, Vellore, Salem, Erode and Kumbakonam while they reveal a fall of 11 per cent. in Madura, 7 per cent. in Vizianagaram, 4 per cent. in Trichinopoly, 3 per cent. in Guntur and 1 per cent. in Cocanada, Ellore and Bezwada and a rise of 6 per cent. in Nandyal and 2 per cent. in Nellore.

Cotton 1936—37--Intermediate forecast—Report. The Cocanadas cotton in parts of the Guntur district has recovered from the effects of the cyclone on the 28th October 1936 and is now in buds and flowers. The condition of the crop is also fairly satisfactory in the other important cotton growing districts.

The wholesale price of cotton lint per imperial maund of 82 2/7 lbs. as reported from important markets towards the close of December 1936 was Rs. 19—12—0 for Cocanadas, Rs. 25—11—0 for Red Northerns, Rs. 19—0—0 for early crop Westerns, Rs. 25—12—0 for Cambodia, Rs 24—11—0 for Coimbatore Karunganni, Rs. 21—13--0 for Tinnevelly Karunganni, Rs. 21—4—0 for Tinnevellies and Rs. 21—13—0 for Nadam Cotton. As compared with the prices in the previous month, the prices reveal a rise of about two per cent in the case of Westerns, Cambodia, Coimbatore Karunganni and Nadam and a fall of about 2 per cent in the case of Tinnevelly Karunganni and Tinnevellies while the prices of Cocanadas and Red-Northerns are stationary.

Groundnut—1936—Fourth or final report. The average of the areas under groundnut in the Madras Presidency during the five years ending 1934—35 has represented 45·4 per cent of the total area under groundnut in India.

The area sown with groundnut in the Presidency in 1936 is estimated at 3 426,500 acres. When compared with the corresponding estimate of 2,480,500 acres for the previous year and the actual area of 2,519,965 acres according to the Season and Crop report of the previous year, the present estimate reveals an increase of about 38 per cent and 35 per cent respectively. The estimated area for this year exceeds the average area of 3,268 550 acres by 4 8 per cent. The area reported in respect of Vizagapatam, West Godavari, Kistna and Malabar districts are highest on record.

The increase in area is general outside Tinnevelly and is marked in the Deccan (+476,903 acres).

The harvesting of the summer and early crop of groundnut had concluded by the end of October. The harvesting of the winter or main crop is proceeding.

The crop is expected to be above normal in Kistna (125 per cent), normal in Vizagapatam, East Godavari, Chittoor, Coimbatore, Ramnad and Tinnevelly and below normal in the other districts notably in Trichinopoly, where it was affected by drought and caterpillar attack and the seasonal factor was reduced in consequence to only 75 per cent of the normal which is about the lowest reported in recent years. The seasonal factor for the presidency works out to 94 per cent of the average as against 95 per cent in the previous year according to the Season and Crop report. On this basis, the yield is expected to be 1,652,200 tons of unshelled nuts as against 1 201,860 tons in the previous year, an increase of 37·5 per cent. The yield in an average year is estimated at 1,616,390 tons.

The wholesale price of groundnut shelled per Imperial maund of 82-2/7 lbs. as reported from important markets towards the close of December 1936 was Rs. 6—5—0 in Cuddalore Rs, 6—1—0 in Cocanada, Rs. 6—0—0 in Vizagapatam, Rs. 5—14—0 in Negapatam, Rs. 5—10—0 in Cuddapah, Rs. 5—9—0 in Guntur, Rs. 5—8—0 in Vizianagaram and Nandyal, Rs. 5—7—0 in Vellore, Rs. 5—6—0 in Bellary, Rs. 5—3—0 in Salem and Rs. 4—3—0 in Tinnevelly. As compared with the prices for October 1936, these prices reveal a rise of 21 per cent in Nandyal, 15 per cent in Cuddapah, 10 per cent in Vizagapatam and Vellore, 6 per cent in Cuddalore, Salem and Negapatam and 5 per cent in Vizianagaram and a fall of 3 per cent in Cocanada whilst they remained stationary in Guntur and Tinnevelly.

Crop--Gingelly—1936-37—Third Report. The average of the areas under gingelly in the Madras Presidency during the five years ending 1934-35 has represented 11·6 per cent. of the total area under gingelly in India.

The area sown with gingelly up to the 25th December 1936 is estimated at 511,900 acres. When compared with the area of 449,100 acres estimated for the corresponding period of last year, it reveals an increase of about 14 per cent.

The increase in area is general outside West Godavari, Kistna, Kurnool, Nellore, Trichinopoly, the South (except Tanjore) and South Kanara. The increase is marked in Vizagapatam (+37,000 acres) and Chingleput (+11,400 acres).

The main crop has been harvested except in the south where the harvest is in progress. The crop suffered from drought to some extent and the yield is reported to be below normal except in Kistna, Guntur, Kurnool, Cuddapah, Nellore, Tanjore, Ramnad, Tinnevelly and South Kanara.

The seasonal factor for the Presidency works out to 91 per cent. of the average as against 92 per cent. for the corresponding period of last year. On this basis, the yield is estimated at 62,800 tons as against 55,900 tons for the corresponding period of last year, an increase of about 12·3 per cent.

1937—Ginger crop—Final Report. The area under ginger in 1936 is estimated at 10,000 acres in Malabar as against the actual area of 9,913 acres in the previous year.

The yield is estimated to be normal as against 80 per cent. of the normal in the previous year. On this basis, the total yield is expected to be 3,580 tons of dry ginger as against 3,370 tons in the previous year.

1936—Pepper crop—Final Report. The area under pepper in 1936 in the districts of Malabar and South Kanara is estimated at 94,000 acres in Malabar and 8,500 acres in South Kanara as against the final area of 89,453 acres in Malabar and 8,528 acres in South Kanara in the previous year.

The condition of the crop is generally fair. The early outbreak of the South-west monsoon affected the flushing of the crop to some extent and there was shedding as usual. The seasonal factor is estimated at 90 per cent. of the average in Malabar and 95 per cent. in South Kanara as against 90 per cent. in

each district in the previous year. On this basis, the yield is estimated at 12,700 tons for Malabar and 1,210 tons for South Kanara as against 12,200 tons for Malabar and 1,150 tons for South Kanara estimated in the previous year.

The wholesale price of pepper per imperial maund of 82-2/7 lb. as reported from important markets towards the beginning of January 1937 was Rs. 16—10—0 in Calicut, Rs. 17—7—0 in Tellicherry and Rs. 18—3—0 in Mangalore. As compared with the prices in August 1936, these prices have risen by about 33 per cent. in Calicut, 49 per cent. in Tellicherry and 38 per cent. in Mangalore.

Weather Review (DECEMBER 1936.)

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·0	-0·7	80·3
	Berhampore *	0·0	0·0	58·3
	Calingapatam	1·4	0·7	46·7
	Vizagapatam	2·8	2·1	39·7
	Anakapalli *	0·0	0·0	...
	Samalkota*	0·0	0·0	...
	Maruteru *	0·0	-0·6	55·4
	Cocanada	1·3	0·4	69·3
	Masulipatam	0·0	-0·9	47·4
	Guntur*	0·0	-0·1	46·8
Ceded Dists.	Kurnool	0·1	-0·1	16·9
	Nandyal	0·0	-1·2	23·3
	Hagari *	0·0	-0·4	24·6
	Bellary	0·0	-0·1	17·7
	Anantapur	0·0	-0·3	17·4
	Rentachintala	0·0	...	24·4
	Cuddapah	0·0	-0·9	21·1
	Anantharajupet *	2·1	...	...
Carnatic	Nellore	0·6	-2·6	70·1
	Madras	2·0	-3·8	44·3
	Palur *	4·6	-3·4	48·3
	Tindivanam *	1·6	-3·3	31·2
	Cuddalore	5·0	-2·2	47·5
Central	Vellore	0·5	-2·2	33·6
	Salem	1·0	-0·0	32·6
	Coimbatore	0·2	-1·0	21·5
	Coimbatore Res. Inst. *	0·3	-2·0	20·3
	Trichinopoly	1·5	-1·1	31·6
South	Negapatam	7·9	-3·5	40·8
	Aduthurai *	8·4	-0·7	41·5
	Madura	1·4	-0·4	29·9
	Pamban	9·7	2·2	38·1
	Koilpatti *	2·1	-0·6	24·6
	Palamkottah	2·2	-1·8	29·1
West Coast	Trivandrum	2·6	0·2	72·9
	Cochin	0·4	-1·3	115·5
	Calicut	0·7	-0·4	135·7
	Pattambi *	0·0	0·0	...
	Taliparamba *	0·1	-0·9	130·8
	Kasargode *	0·2	-0·9	155·2
	Nileshwar*	0·0	-0·8	138·3
	Mangalore	1·0	0·5	163·0
Mysore and Coorg	Chitaldrug	0·2	-0·3	20·1
	Bangalore	0·1	-0·4	30·3
	Mysore	0·0	-0·3	36·7
	Mercara	0·0	-0·7	151·1
Hills.	Kodaikanal	4·4	0·0	74·8
	Coonoor*	4·0	...	73·3
	Ootacamund *	0·6	-2·3	55·3
	Nanjanad *	0·5	-1·4	52·7

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 (published in Fort St. George Gazette).

During the month eight western disturbances affected the weather over North West India. Some of them in their passage caused fairly wide spread rain in the Punjab, Kashmir, North West Frontier Province, Baluchistan, Sind and United Provinces.

Conditions became unsettled in the Bay of Bengal in the neighbourhood of the Andamans on the 1st. On the 3rd they extended into the East Central Bay and concentrated into a depression west of Andamans. Moving westwards the depression weakened into a trough of low pressure standing from the South to Central Bay of Bengal on 4th, 5th and 6th and became unimportant by about the 8th. In association with this seasonal trough of low pressure in the Bay of Bengal a few falls of rain occured intermittently in Assam, South and South East Madras, North Madras coast and Malabar during the first half of the month. Local rains were also reported from South and South East Madras on 10th, 11th and 12th.

During the second half of the month with the strengthening of the North-East Monsoon in the south west Bay of Bengal and South East Arabian Sea, local rain fell in south east Madras on the 16th and 17th. Thunder storms have also caused general rain in the United Provinces, Central Provinces, Assam, Bihar, Orissa, Hyderabad, South and South East Madras, North Madras coast and at a few stations in Malabar.

The month's rainfall was in large defect in South East Madras and slight to moderate defect in other parts of the Madras Presidency and Mysore.

Weather Report for the Research Institute Observatory:—

Report No. 12/36.

Absolute Maximum in shade	88·2°F.
Absolute Minimum in shade	59·6°F.
Mean Maximum in shade	84·6°F.
Departure from normal	-0·3°F.
Mean Minimum in shade	66·8
Departure from normal	+1·0°F.
Total rainfall	0·33
Departure from normal	-2·0"
Heaviest fall in 24 hours	0·30"
Total number of rainy days	1 day.
Mean daily wind velocity	1·5 M.P.H.
Mean humidity at 8 hours	76·0 %
Departure from normal	-3·7 %

Summary. Rainfall was in large defect. Mean Maximum temperature was below normal by 0·3° and the mean minimum above normal by 1·0°.

College News & Notes.

It is pleasing to note that M.R.Ry. Rao Bahadur T. S. Venkataraman Avl., Government Sugarcane Expert and one of our former Editors has been awarded the title of C. I. E. in the New Year Honours.

It is learnt that Mr. K. Ramiah, Paddy Specialist, and also a former Editor will be leaving the Agricultural Research Institute shortly to take up the post of Geneticist and Botanist at the Institute of Plant Industry, Indore.

The Annual Meeting of the Association of Economic Biologists was held on the 1st February 1937 and the following new office bearers were elected.

President:	Mr. K. Krishnamoorthi Rao.
Vice-President (Resident):	Dr. J. S. Patel.
Secretary:	Mr. M. C. Cherian.

Mr. V. Ramanatha Ayyar, the retiring President, delivered his address on The Herbaceum Cottons in India."

Departmental Notifications.

Transfers and Postings. Mr. P. K. Parameswara Menon, A. D., Namakkal to be D. A. S., Coimbatore; Mr. D. S. Subramania Iyer, A. D., Rasipuram to be in additional charge of Namakkal; Mr. M. Narayana Iyer, A. D., Jammalmadugu to IV Circle; Mr. S. Venkataramanappa Officiating A. D., IV circle to Dry Farming Station Hagari; Mr. P. K. Natesa Iyer, A. D., Manamadura to Agricultural College as Assistant Lecturer in Agriculture; Mr. M. Bhavani Shanker Rao, A. R. S., Tindivanam to Coimbatore. Mr. V. V. Rajagopalan, A. R. S., Kasargode to A. R. S., Tindivanam.

Leave. Mr. A. Chidambaram Pillai, A. D., Van Duty, l. a. p. for four months from 1—2—37; Mr. I. Kumara Rao, A. R. S, Anakapalle, l. a. p. on medical certificate for two months from 4—1—37 with permission to prefix Xmas and New Year holidays; Mr. V. Suryanarayana, Assistant Lecturer in Agriculture, l. a. p. for eight days from 25—1—37 with permission to prefix the Penultimate Saturday the 23rd and Sunday the 24th January and on half average pay for 1 month and 19 days in continuation thereof with permission to suffix the Mohurram and Easter holidays; Mr. M. Subramaniam Pillai, D. A. S., Coimbatore, l. a. p., for one month from the date of relief Mr. P. Kannappa Pillai, VII circle extension of l. a. p. on m. c. for 1 month and 12 days. Mr. T. Rangabrahma Rao, A. R. S., Anakapalle, l. a. p. for two months on m. c from 21—1—37. Mr. A. P. Balakrishna Nayar, l. a. p. on m. c. for two months from 28—1—37.

ADDITIONS TO THE LIBRARY, DECEMBER 1936

A. Books.

1. Pedology. *Joffce, J. S.* (1936). 2. Farm Machinery—Text and Handbook. *Cook, G. C. etc.* (1936). 3. Mixed Farming in East Africa. *Morrison, O. R.* (1935). 4. Tobacco Diseases and Decoys. *Wolf, F. A.* (1935). 5. The Garden Encyclopaedia. *Seymour, E. L. D.* (1936). 6. Horticulture (Vocation Agri. Ser.). *Stuckey, H. P. & Mathews, C. D.* (1935). 7. Diseases of Vegetable Crops. *Walker, J. C.* (1936). 8. A Digest of Pasture Research Literature in U. S. A. and Canada (1885—1935). *Pieters, A. J.* (1936). 9. Selecting, Fitting and Showing Dairy Cattle. *Lattig, H. L. & Nordby, J. E.* (1935). 10. Practical Dairy Tests and Fundamentals of Dairying. *Burke, A. D.* (1935). 11. Elements of Livestock Judging. *Smith, A. A.* (1930). 12. Dairy Industry and the U. S. A. (Agrl. Adjustment Act). *Black, J. D.* (1935). 13. Feeds and Feeding (20th Edn. Rev.). *Morrison, F. B.* (1936). 14. Growth Hormones in Plants. *Jensen, F. B.* (1936). 15. Evolution and Heredity. Theories and Problems. *Felker, S. M.* (1936).

B. Reports.

1. Report on the operations of the Madras Agri. Dep. for 1935—1936 2. Report of the Madras Industries Department for 1936. 3. Annual Report of the Rice Res. Stn. Berhampur (Madras) for 1934—1935. 4. Annual Report of the Rice Res. Schemes at Bankura and Chinsura (Bengal) for 1934—1935. 5. Annual Report of Rice Res. Stn., Sabour (Bihar and Orissa), 1934-35. 6. Annual Report of Rice Res. Officer, Burma for 1935. 7. Annual Report of the Rice Res. Stn., Nagina (U. P.) for 1934—1935. 8. Punjab Season and Crop Reports for 1936. 9. Report on the Operations of the Burma Agri. Dep. for 1936. 10. Report of Agri. Stations, Burma for 1936. 11. Burma Season and Crop Report for 1936. 12. Reading

National Inst. for Dairying Annual Report for 1935. 13. St. Lucia Agri. Dep. Annual Report for 1935. 14. Research Abstract Report of Agri. Dep. St. Lucia for 1935.

C. Special Publications.

15. Recent Improvements in the Simple Clarification for New Sugar Production. 16. Proceedings of the 3rd Annual Citrus Institute sponsored by Edinburgh College, 1934. 17. Massechusetts Horticultural Society Year Book, 1936. 18. Agriculture: Outlines of Instruction for Educational Advisers and Instructors in Civilian Conservation Corps. 19. American Experiments to find the most suitable method of Applying Artificial Fertilisers for various crops.

D. Bulletins, Memoirs Etc.

20. Diseases of Sugarcane and Methods for their Control. *I. C. A. R. Mis. Bul. 10.* 21. Cultivation and Curing of Cigarette Tobaccos (Nicotians Tobaccum). *U. S. Agri. Dep. Bul. 71.* 22. Commercial Flower Production, Part I. *Eng. Min. Bul. 96.* 23. Fruit: A Summary of Figures of Production and Trade relating to Apples etc. *Eng. I. A. C Pubn.* 24. Use of Irrigation water on Farm Crops. *Canada Agri. Pubn. 509.* 25. Pneumatic Equipment for Farm Tractors. *Rubber Growers' Assn. Bull. 1.* 26. Pneumatic Equipment for Horse Drawn Vehicles. 27. Rubber for Roadless Tractors and Trailers. 28. The Care and Cleaning of Milking Machines. *Ibid. Bull. Nos. 2, 3, 4.* 29. On the Biology of Red Scale. *Palest. Agri. Exp. Stn. Bulletin No. 15.* 30. Influence of Fixatures on Stomatal Behaviour: Critical Remarks on the value of Lloyd's alcohol fixation method for measuring stomatal aperture. 31. The Florida Wax-scale. 32. On citrus Fertilization with special reference to seedliness and seedlessness of the Jaffa Orange. 33. Phytophthora Stem and Tip Blight of Citrus Seedlings. *Ibid Bull. Nos. 16, 17, 18, 20.* 34. Milk Production Costs in West Virginia 1. A Study of the Costs incurred by 51 Farms in the Morgantown and Fairment Markets in 1934—1935. *W. Virgin. A. E. S. Bull. 268.* 35. Grape Growing in Colorado. *Colorado A. E. S. Bull.* 36. Cover Crops for Soil Conservation. *U. S. Farm Bul. 1758.* 37. Incomplete Milking in relation to Milk Production and Udder Troubles in Dairy cows. *U. S. Tech. Bull. 522.* 38. Statistics of Farmers' Co-operative Business Organisations 1930—1935. *Wash. Farm Credit Admn. Bull. 6.* 39. Homemade Centrifugal Pump and other water-lifting devices. *Montana A. E. S. Bull. 324.* 40. Packing Minnesota Fruits for Market. *Minn. A. E. S. Bul. 323.* 41. Karylogische and Genetische Studien etc. *Ryoto Col. Mem. Gen. Ser. No. 38.*

E. Circulars, Leaflets Etc.

42. Leaf Curl Disease of Chillies. *Madras Agri. Dep. Leaf. 73.* 43. The Grading of Eggs according to the Canadian standards. *Canada Agri. Dep. Pubn. 504.* 44. Studies in Fruit Disease. IA. Apple Scab. *Ibid. Pubn. 519.* 45. Blue Grama Grass for Erosion control and Range Reseeding in the Great Plains and a Method of Obtaining Seed in Large Lots. *U. S. Agri. Dep. Cir. 402.* 46. Grace Growing in Kansa. *Kansas Agri. Exp. Stn. Cir. 177.* 47. Poultry Management. *Ibid. Cir. 178.* 48. Plant Forcing with Electric Lights. *Indian A. E. S Cir. 206.*

Madras Agricultural Journal

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Editorial.

Sugar. Today, sugar has become a primary necessity and "is recognized as a stratagic military requirement in wartime furnishing about 13 per cent. of the total energy we obtain from foods". The investigations of numerous chemists, biologists, plant breeders and technologists have made the growing of sugarcane and manufacturing of sugar one of the most efficient industries. In providing sugar at reasonable prices with due regard for a decent living for the sugarcane farmer, the most important part of the task devolves upon the plant-breeder. The continuous procession of varieties of sugarcane that we see emerging from the Coimbatore Sugarcane Breeding Station, amply demonstrates that the cane-breeders are ever alive to meet the challenge of diseases, pests and altered environmental and economic conditions.

We invite the attention of our readers to an article on "Sugar Tangle" in the current issue of the Journal. The author has referred to two important issues that India will have to face in the near future.

The recent expansion in the cultivation of the sugarcane and in the manufacture of sugar has been so rapid that there is an imminent danger of the supplies of sugar over-reaching the Indian demand, creating the complex problem of adjusting sugar supplies to requirements. In this connection attention may be drawn to the system of production-adjustment contracts which prevail in the United States of America, Philippine Islands, Porto Rico and Hawaii. The farmers who curtail the area are paid compensation for the losses consequent on the reduction of the area. The adjustment programme is largely financed through the income from the processing taxes on the industries which in sugar, is one half cent (3 pies) per pound of sugar. It is claimed that the corresponding reduction (one half cent per pound) in the import duty prevented an increase in the cost of sugar to the consumer. It may, however, be pointed out that limitation of production either through competition or co-operation, restricts the employment. In eliminating surplus of goods a surplus of labour and capital is created.

The only other alternative is to export the surplus of sugar with the aid of the subsidies. With the production unchecked, such subsidies involve presenting to foreigners at less than its value. There would then be an ever increasing gap between domestic and world prices. The world has already given clear indications that it would interpose effective barriers to dumping.

In April, the Tariff Board will enquire into the problems of sugar industry. Maximum benefit must accrue to the producer with the imposition of minimum cost on the consumer. Whether this obtains at present or not is a point to be looked into by the Board. When the internal competition is very keen the tariff is generally not effective in maintaining returns to the growers. This is an additional point in favour of limiting the area under cane. In most of the modern countries, the unemployed are supported by the tax-payers and when the consumer expends more for the goods manufactured by the tariff protected industries, he actually pays to maintain the employment and thus prevents the increase among the unemployed.

The interest of the consumers can be protected against excessively high prices, by adjusting the excise duty or the import duty in accordance with the difference between the average wholesale price of sugar and the price based on the fair margin to the grower and the manufacturer.

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We are glad to announce that a book on "Livestock of Southern India" by Captain R. W. Littlewood, Deputy Director, Livestock, has been published and is available for sale at Rs. 3—6—0 a copy either from The Superintendent, Government Press, Madras, the Principal Agricultural College & Research Institute, Coimbatore, or any of the Deputy Directors of Agriculture.

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SUGAR TANGLE

BY RAO SAHIB V. MUTHUSWAMI AYYAR

Amongst the more important crops grown in India sugarcane occupies an honoured place. But no adequate attention had been paid to this crop until the sugarcane section was organised in Madras in 1911. Other countries like West Indies, Cuba, Mauritius, Java, Formosa and Hawaii which introduced sugarcanes later managed to forge ahead so much so that Java was able to export large quantities of sugar to India for several years. Java's position in 1930 could be summed up in the statement: acreage 484,984; tons of cane harvested 25,292,273; tons of sugar exported to India alone 351,735 (metric), in 1929–30 the area under cane in India was 2,677,000 acres. "From this," says Sir Bryce Burt "was produced 21150 tons of sugar refined from gur, 89,768 tons of sugar produced direct from canes by modern factories, and some 200,000 tons of sugar manufactured by the indigenous open pan or Khandsari process, so that allowing for setts for planting and cane for chewing, 1,837,000 tons of gur were produced for consumption as such."

Although Coimbatore seedlings had established their name throughout the sugar world, there was still a gap—a wide gap between production and consumption in India itself. In 1929–30 these varieties were grown on an area of 549,025 acres. The imports into the country were enormous. India was not self-sufficient. She was at the mercy of Java. Public feeling asserted itself and government reciprocated with commendable alacrity. The question of fiscal protection was referred to the Tariff Board in 1930. Protection was decided upon in 1931.

There was in consequence phenomenal increase in sugar production in India. The area under improved varieties alone in 1934–35 exceeded 2,400,000 acres, while the total area under cane was over 3½ million acres.

Java to her utter discomfiture has had to reduce her area and production. Her area which was 489,984 acres and her tonnage of cane which was 25,292,273 in 1930 dwindled down to 93,613 acres and 5,152,122 tons respectively in 1934, and no tangible improvement has been recorded during the last two years. Other countries have adopted different measures of adjusting their production and sugar prices. Cuba decided to burn her surplus sugar. West Indies entered into a reciprocal understanding with Canada. Formosan sugar was largely absorbed by Japan.

Still the evolution of new types at the Coimbatore Imperial Cane Breeding Station from year to year covering a wide range of suitability and usefulness, the results of trials of promising Coimbatore canes in several provinces under varied conditions of soil, climate,

cultural and manurial treatment serve only to stimulate further increase. This is reinforced by the passing of the Indian Sugar Excise Act of 1935 and by the conviction that protective duties will be in operation for another eight years which gives sufficient time for consolidation of the industry and for making it stand on its own legs. That tendencies point in this direction is shown in the latest official sugarcane forecast for 1936—37. The figures are, area sown 4,431,000 acres, raw sugar (gur or jaggery) 6,717,000 tons." Imports into India have almost ceased.

For a population of 380 millions in 1937 the annual consumption at 18 lb. in terms of refined sugar per head is more than met by production in the country itself even assuming that 2 tons of raw sugar are needed to produce 1 ton of refined sugar. At the present rate of increase in area, a time will soon come when India will have to think of stimulating local consumption or of entering world markets and putting in large quantities of sugar in competition with other countries. Neither of these two methods would seem to offer satisfactory solution, under the present state of economic dependence of India on other countries.

With increased production and no outlet for surplus sugar, the alarmingly low economic condition of the people to which Sir H. P. Mody drew pointed attention in his speech on the Finance bill in the Indian Legislature in March 1936 and in support of which he quoted the following figures would become worsened.

Countries.	National income.	Industrial production.	Bank deposits.	Savings deposits.
	Rs.	Rs.	Rs.	Rs.
U. S. A.	2000	720	...	...
Canada	1300	470	...	..
United Kingdom	1100	410	700	270
Japan	270	158	250	90
India	100	20	7	2

In these circumstances therefore the institution next April of a Tarriff Board for enquiry into the problems of sugar which bristle with peculiar difficulties will be welcomed by all. The taxpayer looks forward however with hope that the terms of reference to this Board will be wide yet precise, that their enquiries will cover a wide field yet be exhaustive, and that their recommendations will come upto the expectations of the country which now feels that considerable improvement is desirable and possible without restriction of area or curtailment of activities of the scientific departments, but with due regard to adjustment and readjustment of cropping and regulation of tariffs. With increased and more effective voting strength vouchsafed under the Government of India Act of 1935 which comes into operation in April and which has introduced a tremendous revolution in his outlook, the villager would rest satisfied only when he feels his interests have not been made to suffer even to a small degree.

A NEW ENEMY OF THE INDIAN HONEY BEE

BY M. C. CHERIAN, B. A., B. Sc., D. I. C.

and

V. MAHADEVAN

(*Madras Agricultural Department*).

Introduction. One of the obstacles for the rapid spread of apiculture as a cottage industry in South India is the presence of a number of bee enemies. The Indian Honey bee-*Apis indica* is often troubled by various enemies such as the Wax moth (*Galleria melonella*), the yellow banded wasp (*Vespa cincta*), the Death's head moth (*Acherontia styx*), ants, robber flies (Asilidae) not to speak of lizards, bugs, frogs, spiders, etc., which also levy a heavy toll. Recently a new enemy—*Palarus orientalis*—has been added to this formidable list and the present paper deals with the life history and habits of this wasp together with control methods for the same.

Description of the pest. *Palarus orientalis* belongs to family sphecidae, series sphecoidea, sub-order Petiolata of order Hymenoptera. The adult wasp is black in color with pale white transverse stripes on the dorsal surface of the abdomen.

The prothorax has basal transverse yellow line and the mesothorax two median longitudinal stripes. The metathorax has a pair of oblique yellow patches.

The female wasp is 12 mm. long with a wing expanse of 20 mm. The male is smaller in size than the female with a length of 9 mm. and wing expanse of 15 mm. A detailed description of the wasp will be found in Fauna of British India; Vol I; 1897 and in the Annals and Mag. Nat. Hist. Vol. 7 (1911) page 483.

Habits of the wasp. Both females and males appear during sunny hours of the day and perform a series of small flights from one place to another, copulation generally taking place at this time, Meanwhile the female pitches upon suitable places for digging tunnels. She sits upon the loose sand and begins to make holes by throwing up sand particles by the action of her legs and mandibles. She burrows into the sand and continues the process of throwing up sand particles. For some time the wasp is visible but as it goes deeper and deeper the loose sand from above falls into the narrow gallery thereby making it impossible to trace it. After finishing the burrow the wasp comes up making an opening in about an hour. First she flies to and fro with her head always towards the hole, then in circles with slight turnings, gradually widening them until, all on a sudden she changes her direction towards the hive. While going in search of prey, she does not close the mouth of her tunnel.

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Preying. The scene is now shifted to the hive entrance. The wasp sits upon the alighting board with its back towards the hive entrance and looks alert and busy by vibrating its antennae and wagging its abdomen. She attempts to pounce upon every flying bee. Generally it catches hold of outgoing bees. But bees with pollen loads have also been observed being made victims. Bees are held on the dorsal side, by the front legs of the wasp. Bees writhe and struggle for release, but they are incapable of stinging in that position. When the bees struggle much the wasp drops them down but in a few moments takes them up again.

Stocking bees. Within about 5 to 10 minutes the wasp returns to her tunnel with her victim. She hovers for sometime and dropping the bee just at the edge of the tunnel, shoots inside it and then drags it into the tunnel. After about 3 to 5 minutes she again appears and repeats the process of gathering bees. This she continues to do for a period of 1 to 1½ hours collecting as many bees as possible. Till that time the tunnel is left open; afterwards she pushes up some quantity of moist sand from inside to close the tunnel and remains in her nest for about 2 hours after which she reappears and begins preying in a similar manner as she did in the forenoon. Afterwards she goes inside the tunnel closing it once again. When the conditions are unfavourable the wasp stops the work temporarily and remains inside by closing the tunnel and the work is resumed after the expected bright weather starts again.

The tunnel. In the moist sand (below the loose sandy layer) there are three or four separate apartments or pockets about 3 to 4 inches apart from each other in which are stored groups of bees varying from 2 to 6 in number. All these lie within a surface area of one square foot.

The egg. In each group of bees there will generally be one egg deposited on one of them but sometimes none may be found in a group of even three or four bees. The egg is seen thrust between the head and throax of the bee, the free end curling a little over the ventral side of the thorax and passing between the front and middle legs. The egg is white in colour, about 3 mm. in length and 1 mm. in cross section.

The larva. The egg hatches on the second day and the small larva is more or less of the same size but its color is slightly dull. Naturally the grub begins to consume the first victim on whose body it hatches. It takes about two days to consume the first bee. In the first five days the larva feeds on all the bees in the pocket leaving only the outer shell of the abdomen, throax, head, wings and legs as remnants. The length of the full grown larva is about 15 mm. On the 6th day it begins to spin its cocoon and on the 7th day it completes spinning. Hence the active larval period is five days.

The cocoon is made of sand and the remnants of the bees. It is a neat oval shell about 12 mm. long and 3 mm. in cross section. In about two days the cocoon becomes hard.

The pupa. The pupa when fresh is pale white in color and later becomes brown. It is about 10—11 mm. long and 3½ mm. broad. Adult wasps emerge from the pupae in due course.

How the wasp affects the bee colony. The loss caused by these predatory wasps is serious since each wasp is capable of robbing about 15—20 bees in a day. If there are more than one wasp preying in a day and if this repeated for a number of days the loss to the colony will be severe. Apart from the actual loss due to the visits of these robbers the routine work of the colony is disturbed. Most of the bees become guards and thus the number of bees going out foraging decreases. The colony therefore never works well and consequently brood rearing becomes slack. Moreover there is an increased tendency for bees to sting freely.

Localities. The wasp has been observed in the following places:- Tirur, Edappal and Ponnani in Malabar District, Tiruchengode in Salem District; and Telungapalayam in Coimbatore District.

Remedial Measures. One of the methods of dealing with the wasp is to locate its nest and destroy it. The location of the nest is not a difficult matter as the wasp as soon as it catches the prey carries it to the tunnel. The direction of its flight can be observed and the nest located without difficulty. It is also possible to handnet the adult wasps during the bright hours of the day. By these two methods the pest can be controlled satisfactorily.

THE STORY OF COFFEE

BY S. DORASWAMI AIYAR, B. A.,

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According to some botanists, the Coffee plant is indigenous to Arabia, while some think that it may have been indigenous to Abyssinia and carried from thence to Arabia. Coffee is not mentioned in the Koran. It is believed that the Arabs knew of coffee only in the 14th century and even then it was probably viewed as a medicinal plant. It is also probable that the Arabs were then only preparing a decoction from the succulent rind or pulp of the coffee-cherry, which, as it contains sugar, was liable to ferment and become alcoholic on standing for some time. It was therefore associated with wine and so the zealous followers of the Prophet discouraged the use of it.

The art of roasting the coffee beans and making a decoction from this was probably discovered in Persia in the fifteenth century. A Mohammadan priest of Aden had an occasion to go to Persia where he

found his co-religionists partaking coffee. When he returned to Aden he tested its value in several ways, and, as he specially found it exhilarating and as a preventive against drowsiness, he recommended its use to his followers with whom he used to spend the nights in prayer.

From Aden the knowledge of coffee seems to have spread to Mecca and Medina where it was adopted first by the pilgrims and then by the rest of the people. It is said that within a century after its introduction to Aden the use of coffee, as a beverage, spread to Cairo, Damascus, Aleppo and Constantinople.

However, in Mecca the more orthodox were objecting to the public coffee-houses as they tended to gaming, singing, dancing etc. In 1511, the Governor of Mecca, who was the Viceroy of the Sultan of Egypt, prohibited coffee drinking on the ground that its exhilarating effects were intoxicating and so contrary to the things permitted in the Koran. But the Sultan of Egypt revoked this and reproved his Viceroy "for venturing to prohibit an article of daily food used by the people of the capital of the Empire (Cairo) and by the Sultan himself." In 1524, however, the coffee houses of Mecca had become the scenes of so much rioting that they were closed by the order of the Sultan himself. In Cairo also there were some who considered coffee drinking as lawful and some who did not think so.

In Constantinople attempts were made by some zealots to raise a religious prejudice against coffee drinking by pointing out that the roasted berry was charcoal and that charcoal was not "of the number of things created by God for food". In consequence of this the coffee houses of Constantinople were ordered to be closed in 1554. But, later on a decree was issued declaring that coffee was not charcoal and thereupon the business of selling coffee was resumed. But still later, the Grand Vizier, Cuproli, suppressed the coffee houses on the war breaking out with Candia. This was done under the pretence that its exhilarating effects induced the people to talk with too much freedom about the politics of their country. In course of time, however, the religious and political prejudices subsided and Turkey is now one of the most important countries consuming coffee.

In 1615 coffee drinking was prevalent in Venice. In 1644, it was taken to Marseilles and in 1652, Mr. Daniel Edwards, an English merchant of Smyrna, took to England a Greek servant, by name, Pasqua, who made his coffee. Shortly afterwards Pasqua set up a public coffee house in Cornhill. In 1675, Charles I characterised the coffee houses as seminaries of sedition and endeavoured to close them and it is said that he actually issued a proclamation which, however, was suspended a few days later. By 1688, London had rivalled the Grand Cairo in the number of its coffee houses.

In 1657, the Turkish Ambassador made coffee drinking fashionable in Paris and by 1670 roasted coffee berries were sold even at £5 per pound in Paris. By 1680, coffee drinking was quite popular in Paris.

It is said that even in Europe there was religious opposition to the drinking of coffee. Many sermons are said to have been preached against coffee and in one of them coffee is characterised as "a poison which God made black, that it might bear the Devil's colour".

Until 1690, the world's supply of coffee came from Arabia and Abyssinia. In 1690, live seeds had been conveyed to Batavia. A plant was then taken to Amsterdam and it is said that the Dutch presented a seedling from this to Louis XIV and that seedlings from that plant were sent to Martinique in 1720. During the voyage, the story runs, the ship's supplies of water ran short and the man in charge of the seedlings gallantly saved them by depriving himself daily of the greater part of his allocated portion of water. He had, in consequence, the good fortune to see the plants arrive in safety and a new source of wealth thereby added to the island.

In 1723, coffee was taken by the Portuguese to Java. In 1728 it was introduced into Jamaica and in 1770 to Rio de Janeiro. In all these places the production of coffee increased year after year.

Regarding the introduction of coffee in India it is believed that it was brought to Mysore over two centuries ago by a muhammadan pilgrim named, Baba Budan, who, on his return from Mecca, brought seven seeds with him. By 1825, coffee was growing in the Botanical Gardens at Calcutta. The first systematic plantation of coffee was established in 1830 near Chickmaglur in Mysore state. About the same time coffee was grown in the Shevaroys and the Wynad. In the Nilgiris, plantations were organised only in 1846.

As the cultivation of coffee spread in many countries in the tropics, its consumption also increased rapidly and coffee is now one of the most popular of all beverages and may even be considered as having passed from the position of an occasional luxury to that of a daily necessity, rivalled only by the sister beverage tea.

As a result of the legislative measures prevalent in many countries and as a result of the abnormally high taxation on coffee at various times, recourse was made to adulterate coffee and to find substitutes for coffee. It is even said that no other article of diet is so much and so persistently adulterated as coffee. The principal substances used for this purpose are roasted chicory and roasted beans and corn. Among others of less importance are acorns, dried beet-root, dandelion, mangold-wurzel, turnips, carrots, peas, date stones etc.

When the duty on coffee was high in many consuming countries, there had always been a large number of substitutes for coffee which were more or less satisfactory and some of which even replaced

coffee. But the importance of these substitutes waned as the duty was reduced. Among the more important substitutes for coffee were the following:—*Acron Coffee*, from acrons deprived of their shells, husked, dried and roasted; *almond coffee*, rye or wheat roasted with a few almonds; *bean coffee*, horse-beans roasted along with a little honey; *beet-root coffee*, from the yellow beet-root, sliced, dried in a kiln or oven and ground with a little coffee; *Egyptian coffee*, from chick-peas; *German coffee* from Chicory; *lupin coffee*, *rice coffee*, *rye coffee* etc.

During the Great War, the high price of coffee occasioned an increase in the trade of coffee substitutes and when the importation of coffee was rendered impossible for Germany and Austria on account of the blockade, the manufacture of substitutes for coffee developed there to an enormous extent. Numerous seeds, roots, fruits etc. were tested and even such materials as fruit stones, nut shells and sawdust were used. According to a writer, "there is no materials which has not been made into coffee substitute, from the wild radish to sawdust". It is said that during the War, the number of authorisations granted by the National Food Ministry in Germany for the manufacture of substitutes for coffee was 511.

After the War, however, conditions changed so thoroughly that during the past few years the world production of coffee has been considerably in excess of the demands and that during the past seven years some millions of pounds of coffee have been allowed to be destroyed by burning or otherwise, especially in Brazil, on account of over-production and with a view to secure a reasonable price for coffee.

In our own country, South India is the seat of the coffee planting industry and it is here that coffee drinking is also more popular. The production of coffee in South India is far more than what is required for local consumption and so the surplus is exported to the European countries. In recent years the demands from these countries have not been encouraging and the prices obtainable have also been declining. During the past three years the price of coffee has been low. In order to improve the prospects of trade, a cess is levied on the coffee exported from the country and the amount realised is being utilised for propaganda in this country and abroad for the more extended use of South Indian coffee.

Many virtues have been attributed to coffee drinking. It is said that Sir John Floyer was cured of asthma, after 60 years' suffering, by drinking coffee freely. It is also said to cure gout to promote digestion, and exhilarate the spirits. It has a stimulating effect on the system by rousing the nervous system to fresh activity. The sense of hunger is suppressed and the desire to sleep is driven away. When taken strong, it causes sleeplessness. It is said to dispel flatulency, to remove dizziness of head, to cause biliousness. Drunk in moderation, and especially with sugar and milk, it is perhaps the most wholesome

beverage known. Very strong coffee is said to produce palpitation of the heart, congestion of blood in the brain, trembling of the muscles and similar affections of the nerves.

To produce the beverage in perfection it is necessary to employ the best materials in its preparation. The berries must be carefully roasted by a gradually applied heat until the aroma is well developed and the toughness is destroyed. Too much heat must be avoided, as the volatile and aromatic properties of the coffee, and, consequently, the flavour, are thereby injured; on the other hand, if the berries are roasted too little, they produce a beverage with a raw, green taste, and very liable to induce sickness and vomiting.

The use of berries of uniform size is very important in order to ensure uniform roasting. Nothing injures coffee more than a percentage of small berries that become charred before the others are sufficiently roasted and as charcoal absorbs completely the aroma of coffee, charred berries are objectionable.

The roasted coffee should be kept dry and excluded from air as much as possible. It loses flavour by keeping and it also absorbs moisture from the atmosphere. It is advisable to use freshly roasted and freshly ground powder for preparing the coffee. Boiling water should be poured over the powder in the coffee-pot. This will extract the useful and agreeable matter in coffee and all its flavour and aroma. Boiling the coffee is quite unnecessary and long or violent boiling might even be injurious.

AN ACCOUNT OF THE TOUR OF THE SECOND YEAR B. Sc. (Ag.) STUDENTS

BY P. K. S. MANI

On the third of January we met at Ernakulam. The most striking thing that drew our attention here, was the extent to which the human labour had supplanted cattle labour; even huge waggons were drawn by teams of men. We visited the Tata Oil Mills; we were much impressed on seeing the intricate processes by which oils, particularly coconut oil, are transformed into various articles of luxury and necessity. We next visited the Palace Orchards of His Highness the Maharaja of Cochin. We also went to the Government coconut farm wherein we learnt the details of the cultivation as well as those of several experiments conducted. The next item of interest that we saw here, was the manufacture of coir and coir articles in the firm of W. M. Goodacre & Sons. The fundamental processes are all done by

hand and it was very interesting to watch the dexterity with which the workers made the mats and other articles of high value.

From Ernakulam we went to Trichur where we saw the cultivation of various crops and horticultural plants in the Central Farm. The next day we went to a rubber plantation and learnt the practices and difficulties of a rubber planter. We also studied the ingenious methods of kole cultivation of paddy. We learn that this system of growing paddy was as remunerative as the ordinary method.

Our next halt was at Pattambi. The superintendant took us round the farm and gave us a general account of the cultivation and agricultural practices of Malabar and also explained the work of the station in evolving the various paddy strains. We were also told the details of Pine apple cultivation.

We next moved on to Taliparamba. Being a hilly tract and climatically suited to the cultivation of pepper it was one of the chief pepper growing centres.

Our next visit was to the coconut stations Kasargode and Nileshwar where we learnt the proper methods of coconut cultivation as well as the details of some elaborate experiments carried on by the Oil seeds specialist.

Leaving the coconut farm we went to Mangalore. Here we visited a cashewnut factory and saw the details of curing, grading and preparation of the commodity for the market.

The next place of our visit was Udipi. We saw here a dairy farm and were greatly impressed with the efficient management of the concern. It looked a paying proposition for any of us to take up such a work when we completed our course at the Agricultural College.

We next went to Coorg where we visited orange and coffee plantations and acquired at first hand the details of the cultivation of the two crops.

From Coorg we moved on to Mysore. Here we saw the Kannambadi Dam, the horticultural gardens and the palace dairy. In the last of the places we saw the various breeds of cows. We also went to Mandhiya and studied the cultivation of sugarcane. We took this opportunity to visit Seringapatam as well as the Chamundi Hills.

On the 19th we reached Bangalore, and with a visit to the Indian Institute of Science our tour came to a close. The same night we took train to Coimbatore.

The success of the tour was solely due to the able guidance of Mr. K. Raghavachariar our lecturer and Mr. S. V. Doraiswamy Iyer, the assistant lecturer. We tender our grateful thanks to them.

UNIVERSITY OF MADRAS

MAHARAJA OF TRAVANCORE CURZON LECTURES ON

AGRICULTURAL ZOOLOGY

By Dr. T. V. RAMAKRISHNA IYER, B.A., Ph. D.,

Retired Government Entomologist, Madras.

President:—R. C. BROADFOOT Esq., N. D. A., C. D. A.,

Principal, Agricultural College, Coimbatore.

Mr. President, Ladies & Gentlemen,

I feel it my first duty this evening to express my thanks to the Madras University for the honour they have conferred on me by selecting me to deliver this year's lectures on agriculture under the Maharaja of Travancore Curzon foundation.

I certainly consider it a unique honor to be granted the previlege as an old graduate of the University of being associated with its many distinguished *alumni* who have left their mark as University lecturers; nor can I restrain my feelings of pride and pleasure at my being associated with the lectures endowed in memory of the famous viceroy Lord Curzon; for, little did I dream of such an association with this great personality, when in the spring of 1905, as a raw recruit in the newly started Agricultural Research Institute, Pusa, I had the previlege of witnessing Lord Curzon laying the foundation stone of the first Agricultural Research Institute in India.

I am particularly thankful to the University for graciously allowing me to deliver the lectures on the prescribed agricultural subject at this place (Coimbatore) where, in my opinion, subjects on agricultural topics are sure to command perhaps a better or at any rate an audience which can better evaluate the performance of the lecturer for obvious reasons. And this has given me an opportunity of coming into contact and renew acquaintance with the many officers and students of this institution with which I was intimately connected for over 25 years and from which I retired only a couple of years ago. The previlege therefore of allowing me to deliver the Curzon memorial lectures have enabled me to recall the days when I first entered the Agricultural Department and that of being allowed to deliver the same in this institution has helped to remind me of my connection with it until recently. I beg to be excused for this personal note. Coming to the subject prescribed for the lecture viz.: "Agricultural Zoology", I have again to thank the University authorities for giving due importance to a subject which has received scant attention from any of the Indian Universities; until about the middle of the last century biological (Botanical and Zoological) studies were persued more with the idea of discovering and elucidating scientific

phenomena than with the object of utilising the knowledge so gained towards the every day needs and practical affairs of humanity; in other words very little attention was paid to the applied aspects of biology as compared with the purely academic and intellectual sides of it. This has been the case with all the Indian Universities which have biological subjects included in their curricula of studies. To add to this, there have been existing in recent years among many scientists, especially among many men trained in or connected with the famous universities of the west some short-sided and unfortunate ideas regarding the applied aspects of the natural sciences. Many of them have been feeling that pure Botany or pure Zoology is of higher scientific status than applied Biology and that the Economic Zoologist or Botanist occupies a lower caste. At the International Conference of Botanists in London 1930 one of the leaders exclaimed thus. "At this conference let us have pure botany, real botany; we do not want all that applied stuff"; another said that "we discover facts and principles and you merely apply them to particular problems and nothing more". The late Dr. Barber one of our pioneer agricultural officers in Madras, under whom I had to serve for some time, has more than once taunted me with the remark that Economic Entomology is all a bundle of methods. In certain quarters there is often a three cornered fight between the research worker, the university professor and the applied biologist. The research worker is looked upon by some as an inoffensive but curious member of the social order moving in his own rut and knowing hardly anything of the outside world; the teacher is snubbed as an academic automaton whose place can be easily replaced by a gramaphone, and the applied biologist is regarded as a boorish plug of a farmer or mechanic with neither culture nor status. I have worked in all the three capacities and in my opinion all the arguments are but half truths. It is however gratifying to note that all this snobbery and mutual bickerings especially those between the pure scientist and the applied scientist are gradually disappearing and that they are beginning to realise that it is the proper balance between the two aspects that should be maintained. In the words of professor, Coulter "The physical needs of man great as they may be, must never obscure the intellectual needs of man, especially as the trained intellect is the speediest agent in meeting physical needs. On the other hand the intellectual needs of man, noble as they may be must never lose sight of the fact that the speediest results are obtained by the enormous increase of experimental work under the pressure of physical necessity." The rapid strides of civilisation, the general growing rivalry among the more advanced nations in the exploitation of the rich tropical regions, the frequent wars in that connection and the consequent economic needs of human communities all over the world—all these are compelling man to look for the applied aspects of the different sciences for his future needs. Nor has it to be

forgotten that it is on the foundation of agriculture that all human activities and thoughts depend in the last resort and that agriculture is mainly applied biology. Above all the late war and the events that have followed have demonstrated with great force the absolute dependence of all phases of industrial life upon the single industry agriculture, which, with its associated activities forms the one primal all essential requsite in the successful prosecution ofany enterprise, be it war or peace. The realisation of these stern facts has within recent years given a stimulus to the advance of the applied science. Applied chemistry, applied physics, and economic biology have nowadays begun to loom large in scientific circles and experts in responsible quarters have begun to feel that the motto of applied science and pure sciences should be the same viz. " A practice based on the science and a science that illuminates and extends practice ". It may also be concluded generally that all science is practically one though for conveniences it is divided into different aspects that pure science is often immensely practical that applied science is often very pure, and that between the two there is no dividing line, both being essential for the intellectual and material needs of man. My idea in giving experience to the above remarks was just to indicate the past and present status of applied sciences especially, of applied zoology in India and elsewhere.

Let us now pause for a while and see what the terms applied zoology, Agricultural zoology etc.—terms which are of comparitively recent origin—connote, and comprise in their relation to the science of zoology. As we all know, Zoology is the science of animals—the unravelling of the problem of the origin and nature of animal life—a problem whose complete solution will be the crowning achivement of humanity; and this has been attacked in many ways from the days of Aristotle. Until about the middle of last century however zoological studies were mainly devoted to the following lines.

Different aspects of zoological study. 1. *Morphology*. The study of the form and the structure of bodies of animals. This includes Anatomy, Histology, Cytology and Embryology.

2. *Physiology.* The study of the fuctions of the different parts of an animal separately and in relation to the organism as a whole. This deals with the process of feeding, waste repair, etc : studies on the physics and chemistry of protoplasm may also be included here.

3. *Evolution.* Study of the process which has brought about the great variety and wealth of animals and their distribution and space. Includes Zoogeography, Palaetonomy and Genetics.

4. *Taxonomy.* Classification of animals (Systematic Zoology).

5. *Ecology.* Study of the relations of animals to their environments both living and nonliving, and the various adjustments.

Though investigtions on these lines have been fairly comprehensive and exhaustive, have formed the foundations for all aspects of

zoological studies in the future and have produced remarkable results in the past, aspects of zoological studies regarding animals in their relation to man—in other words—the economic or applied aspects of the science began to receive serious attention only within the past two hundred years or so. Of course, from the very early days when half civilised man gave up his hunting and predatory habits for a settled life and began to grow crops and tend cattle, the various forms of life associated with these early activities also became his life long companions for weal or woe; gradually during ages of civilization as man began to clear wild jungle and grow crops in large areas for his food, clothing and other material needs, his relation with different forms of life became more and more pronounced. But excepting perhaps some of the higher animals like cattle and domestic animals the rest of the animal world interfering with man hardly ever received our serious attentions till recently.

What is economic or applied zoology and what is its scope? It is the study of such animals which are, in brief the friends and foes of man; in other words it is the subject of animals' and human welfare. Human welfare may be briefly brought under three main headings—Health, Wealth, Social and intellectual welfare. Applied or economic zoology therefore is the study of the relations of animals to man, and the utilisation of such knowledge in his endeavours to satisfy the above aims.

Table I.

Important Group of animals.

Animal Kingdom divided into Phyla.	Phylum.	*Protozoa.* One celled animals.
	do.	*Porifera.* Sponge.
	do.	*Coelenterata.* Jelly-fish, corals etc.
	do.	*Echinodermata.* Starfish, Sea urchins etc.
	do.	*Plathyhelminthes.* Flukes, tapeworms etc.
	do.	*Nemathelminthes.* Round worms, worms etc.
	do.	*Annulata.* Earthworms, leeches etc.
	do.	*Mollusca.* Snails, oysters, slugs etc.
	do.	*Arthropoda.* Insects, Crustacea, myriapoda, arachnida etc.
	do.	*Chordata.* Higher animals. (Vertebrata). Lower animals. (Invertebrata).

Table II.

Applied or Economic Zoology (groups).	1. Mammalogy. (Higher animals)	Agricultural Zoology.
	2. Orinthology. (Birds)	Agricultural Zoology.
	3. Entomology. (Insects)	Agricultural Zoology.
	4. Helminthology. (Worms)	Agricultural Zoology.
	5. Protozoology. (Protozoa)	Agricultural Zoology.
	6. Carcinology. (Crabs prawns etc.)	Agricultural Zoology.
	7. Malacology. (Mollusca)	Agricultural Zoology.
	8. Ichthyology. (Fishes)	
	9. Herpetology. (Reptiles)	
	10. Hydrozoology. (Corals etc.)	
	11. Poriferology. (Sponges)	

The two tables might give us some idea of (1) the main subdivisions of the Animal Kingdom and (2) of those groups which possess some economic importance. Of the 11 divisions shown, which in my opinion, play a good part in economic zoology, those from 1 to 7 can be conveniently grouped as animal communities which have something to do with agriculture. If however we employ the term farming or farmer in the wider senses that they are at present used, there is hardly any group of animals which cannot be brought under the above category, for, we hear of ostrich farms, snake farms, coral farming etc. Thus practically Agricultural zoology comprises almost the whole of the field of economic zoology.

Economic Zoology in India. Zoological work in India has been persued in different parts of India from very old times and numerous valuble works have been published till now on Indian animals. Most of these latter, though extremely useful to modern workers in numerous ways were generally of a descriptive, systematic or faunistic nature. From about the middle of the 18th century numerous zoological workers came into prominence. Such were Dr. Koenig of the Tranquebar mission—who wrote about white ants—Drs. Kerr and Anderson of the E. I. Co., who wrote on the lac insects and Dr. Buchanan the famous traveller who wrote on the silk worms. By about the second half of the last century considerable facilities and encouragement were afforded for the study of natural history subjects by the starting of institutions like the Asiatic Society of Bengal, The Bombay Natural History Society and the Indian Museum. The publications issued by these bodies ever since their birth, have included numerous valuable papers on the natural history of India. The real incentive however, for intensive investigations on agricultural zoology came from the interest shown by the Government of India in agricultural matters and the creation of the Imperial Department of Agriculture in India in 1901 and the appointment of the Imperial Entomologist to the Government in 1903. The first Imperial Entomologist was the late Professor Maxwell Lefroy who died under tragic circumstances in the cause of science and under whom I had the previlege of getting my ABC in Agricultural zoology. Our previous knowledge of agricultural or economic zoology was very scanty. Chief among those which devoted some attention to animals of economic importance was the periodical known as the "Indian museum notes" from 1890—1902 which confined its activities chiefly to Economic Entomology. "The pests and Blights of Tea" by Watt and Mann was another. The Fauna of British India volumes on various animal groups published by Government during these years have been of very great service to Zoologists, though they were purely systematic and faunistic. The first really important work on Agricultural Zoology in India was issued in 1906 viz. Prof. Lefroy's "Indian Insect pests". Mr. Stebting of the forest

department published his "Manual of Forest Zoology in India" in 1908 and the next important work on applied Zoology was Fletcher's book "Some South Indian Insects" published in 1914. Since that year considerable work has been done on the various aspects of applied Zoology in different parts of India, especially on Agricultural Entomology. A some what detailed account of this history may be found in my paper published in 1926 on the "Rise and Progress of Entomology in India".

I shall now proceed to give you as briefly as possible some account of the different aspects of Agricultural Zoology with special reference to South India with the help of some lantern slides, I had prepared in this connection. The subject can be dealt with in one or more ways; one method is to dwell on the work of the Economic Zoologists on the different animal groups having relations to agriculture, in their natural order, another way is to treat the economic aspects of animals under different categories such as animals concerned with plants, food, clothing, diseases store-products, livestock etc. I am taking up the former method with slight modifications and shall rapidly refer to each of the important economic groups of animals, indicating their relations to human welfare, especially in relation to South Indian Agriculture. Anything like doing full justice to a large and growing subject of this nature is far beyond the possibilities of even half of a dozen lectures; as such, my idea is to place before you in these two lectures a brief and succinct survey of the more important aspects of the subjects which might perhaps create in some of you at least, some interest on an important subject like this which affects human interest to a very great extent. I may tell you at the outset that among animal groups, which I just pointed out to you as economically important, there is one division viz. insects which is far more important from an agricultural point of view than many others and which has received very great attention at the hands of Economic Zoologists. I hope to deal with this subject of Agricultural Entomology which deserves some special attention after I finish with all the other groups. Starting from the lower ranks of the animal kingdom we have the protozoa or unicellular organisms. It will be seen that in no group of animals has work of such remarkable nature and magnitude been done in such a comparatively short period of time as in this group, and the branch of protozoology having advanced by leaps and bounds, has almost outbeaten many other branches of biological study, in its economic importance. The wonderful researches in the ætiology of malaria, yellow fever, and sleeping sickness, the study of their causative organisms and their life histories in different hosts—these alone of the many other discoveries with the protozoa will be sufficient to indicate some of the outstanding triumphs of modern biological investigations.

Pathogenic.

Protozoa (Agricultural).

Malaria	*Plasmodium spp.*	In man and cattle
Pebrine	*Nosema bombycis*	In silk worms
Cattle Disease	*Trypanasoma spp.*	In horses and cattle
Yellow fever	*Leptospira icteroides*	In man.

There is possibly no greater source of loss to the tropical farmer than that occasioned by the inroads of insidious malaria. It has been shown more than once by competent authorities that in many fertile areas of the world, the progress of agriculture has been greatly retarded by this one factor. The actual loss in money, lost time, employers liability and depleted energy due to active and latent malaria are almost beyond powers of computation. Any one knowing of anything of our hill plantations can testify to the troubles and loss caused to coffee and tea planters during certain seasons in the year when whole gangs of coolies are down with malaria, completely upsetting the work in the estate. Other studies worth noting are the researches in connection with the protozoan organisms causing Pebrine in silkworms, Kala Azaar in man, Surra in horses and Texas fever in cattle. Though most of the investigations are relating to veterinary and medical branches the application of such knowledge in the alleviation of pain and the treatment of some of the deadly diseases to which man and beasts are subject to. has gone a great way in helping agricultural progress. According to Dr. Balfour of the London Tropical School of medicine the deaths due to malaria may be put down roughly at 2 million people every year. Malaria, yellow fever and kala azaar are considered as rural diseases and levy a heavy tax on the human and cattle strength of many countries which depend for their prosperity mainly on agricultural progress. Pebrine affecting silkworms is the earliest known of protozoan maladies, and this disease was on the point of completely ruining the silk industry of France when Louis Pasteur the farmer bacteriologist saved the same by his studies of the pebrine organism (*Nosema bombycis*) and suggested his method of microscopic selection of seeds. Further recent studies on pebrine by Hutchinson in Pusa have considerably helped the silk rearer in India in combating this dire disease of silkworms found in South India Bengal and other provinces. The investigation on the protozoan pathogenic organisms connected with the various protozoan cattle diseases in India are being carried out by experts at the Imperial Veterinary Institute, at Mukteswar.

Before leaving the protozoa it may be interesting to make a passing reference to the recent researches in soil protozoa and their effect on field crops. The biology of the soil fauna and especially, the microbiology—a knowledge of the activities of soil protozoa is a branch of zoology which has not as yet progressed sufficiently in India to enable us to know its economic value. It is believed that some of these

protozoa in combination with bacteria produce certain beneficial and injurious effects on the soils. Russel and Hutchinson have propounded a theory to the effect that many soil protozoa are injurious to the growth of plants and that a partial sterilisation of the soil yeilds better crops; this new theory is likely to lead into interesting avenues of investigations.

Leaving unicellular animals we come to the lowest of multicellular forms, the group porifera including the sponges. It is probably not known to many that sponges are of animal origin and that they have some economic importance. The bath sponge of commerce used for toilet and other purposes is the fibrous skeleton (called spongin) of a colony of minute sponge organisms; this skeleton is rough when dry and smooth when wet. The studies on these creatures have shown that they can be artificially cultivated from cuttings of the live colonies in shallow water and at present sponge farming on a large scale is carried on in parts of the Florida and the Mediterranian Coasts. Of course not having direct agricultural relations we need not dilate on these creatures.

Worms. From sponges we go to the next higher group the Worms, which constitute a very important division of animals both from the purely scientific and the economic points of view. This branch of zoology which is known as Helminthology has received considerable attention from very early times, and latterly the economic importance of these creatures to both higher animals and man has received special attention both from medical men and agriculturalists. From an economic point of view Helminthology can be studied in three important directions viz. in relation to man and livestock in relation to Agriculture and in connection with what is known as Biological control of pests.

The relation of worms to man and livestock consists in many worms living as internal parasites in higher animals and seriously affecting their health. In this respect worms form a very important group to constitute the subject of Animal Parasitology. The most important of these parasitic worms are what are known as tape worms, flat worms and round worms, and the well known representatives are the liver fluke (*Fasciola spp*), the tape worms of sheep, ox, pig and man (*Taenia spp*), the human pin worm (*Enterobius*) the filariasis worm (*Filaria*), the guinea worm (*Dracunculus*) and the notorious hook worm (*Ancylostoma*). According to Cameron " the liver fluke costs Great Britain at least a million pounds yearly and about 10 % of all sheep die yearly from worms. It is well known that numerous diseases and bodily troubles are caused by many of these helminth parasites to cattle and farmers and great loss is caused by their passing their lives in two or more hosts. It may be emphasised that as in the case of malaria, the trouble caused by the hook worm parasite in the different areas of the world is something very serious and noteworthy causing

considerable reduction in industrial efficiency in tropical farms, plantations and factories. The humanitarian work that the health board of the Rockfeller foundation is doing in the direction of alleviation of diseases, especially in relation to malaria and hook worm trouble in various parts of the world is one which cannot be sufficiently admired and appreciated by the world at large. The representatives of the foundation have been and are still doing work on malaria and hookworm in Ceylon and South India. To quote from their report for 1925 " An intensive study of the results of hookworm, treatment of coolies on a tea estate in Ceylon showed that treatment was followed by a rise in the number of red corpuscles in the blood and of the haemoglobin index and by a reduction in the number of coolies at the dispensary and in the hospital and also in the number of working days lost." Speaking of helminths affecting livestock many are the ailments caused to milch and work cattle, horses, sheep and other farm animals, the common ones being liver rot, gastritis, intestinal troubles, lung troubles etc. The Imperial Bureau of Agricultural Parasitology in England and the Animal husbandry wing of the Imperial Council of Agricultural Research in India are now dealing with this aspect of Helminthology seriously affecting livestock which forms the back bone of agriculture and it is hoped very substantial results will follow.

As regards the direct relation of Helminths to agriculture we have the Eel worms which play a very important part. These are minute round worms living as plant parasites and occuring in thousands in the soil with great diversity in form and habits. Though many of these soil forms are harmless some of them cause very serious disease on plants. It may be surprising that the larvae of some of them (*Angiullulina sp.*) revive when moistened after remaining in a dessicated state for seven years, and that some (*Hoterodera sp*) can lie dormant in the soil for a period of ten years or more. Three genera of this group form the most important of these plant pests (*Aplenchoides spp.*) attacking chrysanthemums, strawberries, currants. etc. and causing leaf blotches, galls, bud rot etc. This is not recorded in India as far as I know.

Anguillulina (Tylenchus) a species of this genus—*A. angusta* is known to cause the Ufra disease of paddy in Bengal; other species are known to cause cockle in wheat and galls in rye and grasses and diseases in potato, clover etc.

The third genus is Heterodera including the most notorious of these plant eel worms. The root knot eel worm (*H. marioni C.*) is the best known of these, causing galls in root and stems, of many plants. According to Goodey more than 850 plants as hosts of this creature have been recorded and numerous workers have carried out substantial investigations on this group all over the world. In South India many of our common garden plants, vegetables and crops like

pepper, betelvine, tea, pulses, etc. have been found subject to the attacks of this eel worm. Mr. P. N. Krishna Iyer of this Institute has recently studied the subject and has published some very good papers on this eel worm. The Imperial Bureau of Agricultural Parasitology, London, is also engaged on intensive studies in this direction. One other aspect of nematode activities in connection with agriculture is the discovery that some genera of these parasites are acting as natural agents in pest control; some of these nematodes have been found infesting pests like locusts, leaf and bark beetles, leaf hoppers etc. Well known genera of worms in this direction are Mermis, Gordins and Monnonchus. Though sufficient work has not been done in this direction, the subject offers a new and excellent line of pest control with the help of worm parasites as natural enemies, especially in the control of insect pests of crops. Before we leave the group of worms reference may be made to two other subdivisions belonging to this great group viz., the *Earthworms* and the *Leeches*. It is common knowledge that earthworms and their earthern casts are very familiar objects in our garden and fields and that they are useful to the soil in various ways though unfortunately they sometimes get mixed up as doubtful agents of mechanical mischief in company with eel worms as in the case of the trouble in the betel-vine gardens near Coimbatore. It is found that earthworms make some of the manures more assimilable by the soil, ventilate the latter and bring up large quantities of earth which has passed through their gut. Darwin's studies on earthworms is perhaps well known to most of you and according to him " the level of an acre of soil in England is raised by earthworm casts by one tenth of an inch each year." In some of our ever green and moist forest areas and foot hills, very long earthworms are found measuring upto a foot and a half or more in length. Our commonest genus in South India is *pheretima*. Flat worms (Turbellaria) like *Bipalium* and centepedes (Lithofires etc.) are found to be the special enemies of these earthworms. Leeches, which are well known from very ancient times as having medicinal properties, also play their part in relation to agriculture. Those who have visited any of the hill estates, in the Nilgiris, Anamalais, Coorg or Travancore might have experienced the trouble caused to men by leeches in the coffee, rubber and cardamom plantations. Hardly anyone entering any of these moist plantations in the forest valley escapes from the attentions of those blood suckers. Their work is so cleverly done that their attack is hardly ever felt or noted until long after the creatures have sucked sufficient blood from the host. Coolies working in such plantations suffer a good deal though they occasionally resort to various devices and local drugs to check the trouble. The common hill leeches in S. India belong to the genus *Haemadispa*.

I may also just touch one other fact in connection with the economic aspect of worms, though it is not of any direct agricultural

importance viz. the relation of some larvae of marine worms in pearl formation. Pearls inside oysters are now believed to be caused among other ways by the deposition of nacreous matter around the larvae of parasitic worms attacking oysters; and in Japan after Prof. Mitsukuru's studies they have started production of pearl by artificial introduction of foreign particles inside the bodies of oysters.

Mollusca. Regarding the group of mollusca or (shelled animals) the study of which forms the science of *Malacology* we have not much to note from a purely agricultural point of view. Most of these are aquatic animals and include the oysters, the proverbial slow moving snails and slugs, cuttle fish etc. Many of these are used for food but some of them are occasionally noted as pests of crops. These latter include land snails or breathing forms (*pulmonata*) which are occasionally found attacking aloes, hedge plants and even some cultivated crops like vegetables and flowering plants. The common ones I have found in S. India belong to the genera *Xesta*, *Rhacis* and *Ariophanta*. During the summer months hundreds of these are found attached to hedge plants apparently hibernating. In parts of the Tanjore and Godavari Deltas occasional trouble is also caused by some molluscar forms, to growing paddy. These have to be further investigated for correct information as to the real damage done if any. Snails are a delicacy in France—in restaurants snail dish " Escargot " is sold. Snaileries (farms) also exist around Paris. Slugs are, as you all know fleshy, slow moving creatures, which leave a trail of shining slime behind, often met with in our gardens. Though in some other countries they are noted to cause damage to plants such as rubber, tobacco, sweet potato etc. we have not yet noted any slugs with real pest propensities. *Limax* and *Parmarion* are the well known genera of these slugs. It will be interesting to note that the larvae of glow worms (*Lampyrids*) are very effective enemies of these land mollusca. Before leaving this group, I might invite your attention to the close relations existing between the liver fluke (*Fasiola*) mentioned under worms and snails (*Limnoea spp*) and to the fact that the former passes part of its early life in the body of the latter as an intermediate host.

We will now come to the consideration of the economics of the higher or vertebrate groups of animals, especially in their relations to agriculture. There is hardly any necessity here to dwell on the well known mutual relations of man and many higher animals like cattle, horses, sheep, dogs, poultry etc. which have become his life long companions from very ancient days—such subjects are generally treated under separate branches like Animal husbandry, Stock raising, Sheep breeding, Poultry farming, Pig rearing etc. etc. I shall therefore refer only to those higher animals which are known to be harmful or beneficial to agricultural interests in different ways, about the economics of which our knowledge has been very scanty till lately.

The studies on fishes (Ichthyology) especially those relating to the recognition of edible and poisonous forms, their breeding, spawning and migrating habits and the methods of artificial propagation (Pisciculture) preservation and canning—have all within the last few decades progressed so much as to create various famous and flourishing fisheries all over the world. In India we have fisheries departments under most provincial governments to attend to this important aspect of applied zoology. From the farmers' point of view the discoveries of fish, feeding on malarial mosquito larvae are of great importance. In South India species of *Heplochilus*, *Marcrones* and *Barbus* have been noted as such and trials are being made in different places to introduce such useful forms in malaria ridden areas. It may be interesting to note that among fishes one creature, an eel, a snake like fish (*Opichthys boro*) known in tamil as the "Anaikuthu pampu" is now and then found doing some appreciable harm to paddy fields and salt pans along the coastal areas of the Bay of Bengal from Ganjam down to Negapatam. The damage it really causes (known in telugu as 'Ramasuli') is not like that caused by other animals any direct harm to the growing plants; the injury done is indirect caused by numbers of this eel burrowing into and making wide passage across field and irrigation bunds and connecting the paddy fields containing fresh water on one side and the salt water channels or coastal tidal streams near the sea on the other. This causes the salt water of the estuaries to enter the paddy fields and affect the growth of the plant which, due to the ill effects of the salt water, wither and often die. The damage done to salt pans by this same creature, often in company with crabs, consists in causing the brine collected in the pans for salt to pass away through the openings made and thus leaving the pans empty before the salt has crystallised out. A short account of the creature will be found in a paper of mine published in the Bombay Natural History Society Journal in 1932.

Another point in connection with the economics of fish is the manufacture of fish oil soap from sardines for insecticidal purposes. It is perhaps not well known that while shoals of sardine are caught during certain years these disappear for a long time like locust plagues. This is an important industry along the Malabar Coast and our cheap contact insecticide for crop pests of different kinds is got from the factories in that tract.

Some of us would naturally doubt as to whether such creatures as frogs and toads have any mission or economic importance in this world. As a typical animal for experimental purposes and dissection in science institutions the frog has been found very handy and it is practically the 'martyr' for zoological studies. It is perhaps not widely known among us that the frog is used as an article of food in many western countries, and I had occasions to find them being sold alive for food purposes in the markets of California. Regular frog

farming is carried on in different places and there is said to exist in Ontario a farm in operation for the past 30 years, producing every year 7000 living frogs, in addition to 500 lbs. of dressed frogs' legs which is regarded as a special delicacy; zoologists are employed by these farms to investigate into the life history, breeding season and habits of different frogs so as to keep the industry flourishing. All of us are familiar with the tadpole stage of the frog and it has been found by frog farmers that the tadpole does not change into the tailless frog unless the edge of the natural or artificial pond has a sloping side, and in its absence remains as a tadpole for months together! Another interesting and important problem, with which these frog farmers who have to keep thousands of frogs alive all through the year, is said to be that of feeding them; for, the frog does not eat anything that is not moving though the tadpole in the water eats anything. I have referred to these apparently unimportant facts just to give examples of how small points in zoological studies often become important economic problems. Toads and frogs are very useful as insect destroyers as is found by their presence in numbers near lights especially around electric lights in the streets which attract numerous small insects. Kirkland in his account of his observations on the American toad says that the toad's food is made of about 88% insects and 16% of these are cut worms, and counting these cut worms alone he has estimated the annual saving to the farmer by each toad as 20 dollars or nearly Rs 60. During a pest of army worms he found in toad's stomach 55 worms; so that, as an insect destroyer the toad has few superiors. The common toad of our plains is a Bufo and of our frogs *Rana*. It will be interesting as has been done to some extent in the case of insectivorus birds, to study the nature of the insect food of frogs and toads so as to properly appraise the help they render in checking insect pests.

Coming to the higher group Reptiles, the study of which is known as Herpetology it is found that many of them such as lizards, blood suckers, chameleons etc. are decidedly beneficial in that they are all mostly insectivorus. The amusing and clever work of the wall lizards (*Geckos*) around our lights during nights shows their insectivorus habits. The clever manner in which the green chameleon catches its animal prey is also pretty well known, how it suddenly throws out its long tongue and gulps the prey with the help of its secretion. Though snakes and crocodiles are known to us as dangerous forms to be taken care of in the fields and lakes, some of them are responsible for doing some indirect good, since some of them feed on rats and mice. It will be a very useful thing if the cultivator especially in snake ridden areas near the hills and forests gets some ideas as to the features of harmless and poisonous snakes so as to avoid risks and danger from these creatures. The cobra, the viper, the krait and the ecis are the really dangerous forms, one is likely to meet with in different parts of

South India. The Russel's viper is a common form found in Coimbatore and during the early days of this college, hundreds of these have been killed from prickly pear bushes and field bunds. It will also be helpful if the cultivator knows something about the habits of crocodiles, since in some parts of Malabar and Travancore domestic animals cattle etc. and even he himself often run the risk of being attacked by these in the rivers and tanks. The turtles and tortoises belong to this same group but are not known to play any important part in relation to agriculture, though some of them are edible creatures.

The study of the next higher group of birds (Orinthology) offers us a very wide field of economic possibilities. It is one of the most important of animal groups which affect the farmer and the layman in various ways. Many birds are used as food as we all know such as fowls, duck turkeys, snipe etc. From the layman and farmers' point of view birds are generally classified into useful and injurious forms. Among the latter well known forms are the two species of crow, the Indian house crow and the jungle crow, *Corvus splendens* and *Corvus macrorhynchus*; these two are very troublesome and annoying near houses and on ripe cholam and other cereal crops, they are also insectivorus and do some good when they occasionally feed on crop pests like catterpillars, white grubs etc. It is a common sight to find the crow following the harrow in fields devouring soil insects such as white grubs, cut worm, etc. Of the other birds which may be classed as pests in South India we may note among the well known ones the house sparrow, (*Passer*) Bee eaters, (*Merops*), the green barbet (*Thereicery*), the parrots (*Palaeornis*) the weaver birds (*Ploceus*) the pigeon (*Columba*) the dove (*Turtur*) and the munias (*Munia*). There are also number of extremely useful and beneficial birds which help the farmer in not only destroying insect pests but also acting as flower pollinators in many cases. Among these the well known ones are the larks (*Alanda*) the drong (*Dicrurus*) the mynah (*Acridotheres*) sunbird (*Arachnechthra*) wood peckers (*Brachypternus*) the roller (*Coracias*) the shirks (*Lanius*) the tailor bird (*Orthotomus*) the paradise fly catcher (*Terpasiphone*), the night jar (*Caprimulgus*) the cattle egret (*Bubulcus*) the spotted owlet (*Athene*) the bulbul (*Malpastes*) the seven sisters (*Crateropus*) the tree pie (*Dendrocitta*) the common heron (*Ardea*) etc.

There are again some birds which are of doubtful value as they do not stick to one particular kind of diet; such are the oriole (*Oriolus*) the crow pheasant (*Centropus*) the partridge (*Francolinus*) etc. The birds of prey including the kites, falcons and vultures are also beneficial to a certain extent in that they are sometimes scavengers and offal feeders; but often some of them are dangerous to poultry and small domestic animals. The brahmini kite (*Haliastur*) is a highly insectivorus bird and feeds on also crabs in paddy areas. On the whole birds do a considerable amount of good work in helping the

farmer to get rid of insect and other vermin affecting his crops. A good deal of work has yet to be done however in verifying correctly the food habits of Indian birds, classifying them correctly as friends or foes of the farmer, and then utilising to the best of our ability the good work done by the former and devising ways and means to control the latter.

Though not directly connected with agriculture, a passing note may be made of birds like the egret and the ostrich which are reared for their feathers and plumes which often fetch fabulous prices. The African ostrich, the largest of living birds (*Struthio*) sometimes reaching 8′ in length is reared in ostrich farms in South Africa chiefly for its plumage. Its flesh is not eaten but the egg is relished and is said to contain as much food as two dozen hen's eggs. In North India similarly there are farms for rearing the Egret (the cream white wading bird,) for similar purpose. In India we have also the peacock (*Pavocristalus*) which is not only noted for its valuable feathers, but is regarded as a sacred bird as well.

We now come to the consideration of the higher group of animals the Mammals including man himself and some of his oldest companions the cow, the sheep, horse, cat, dog etc. As I have already told you the economic importance of these higher animals is studied under special branches called Animal Husbandry, Stock rearing etc. Let us see which of the other mammals have become friends or foes of the farmer. Unlike the lower animals the higher animals generally frequent only jungle and grassy areas and enter cultivated fields only occasionally but the harm they sometimes cause is very serious. Some of the commonest of these higher animals which often give a good deal of trouble to the farmer and fruit grower in South India are the jackals, wild pigs, the monkeys, squirrels, and rats. The jackal (*Canis aureus*) causes appreciable damage to coffee berries and sugarcane and frequents hills and plains, forests and open country. It is probably known to some of you that coffee seeds collected from the excreta of jackals in the coffee estates is said to be of the best quality, since the animals eat only the well ripened berries. Nor is the nocturnal howl of the jackals during certain seasons unfamiliar to most of us, even in this college. Sugarcane and root crops also suffer from jackal attack. The depredations caused by monkeys in certain districts is well known and often found very serious. The commonest and the cleverest of the monkey pests we have in South India is the macaque (*Maccacus silenus*). It is found in the plains and the lower hills and is the one led by showmen and street beggars and the one infesting sacred shrines like Tirupathi, Palni etc. According to Jerdon "this is the most inquisitive and mischievous of its tribe and its powers of mimicry unsurpassed". It is easily bred in confinement and docile when young. It has capacious cheek pouches and feeds on insects, roots, nuts, fruits,

cereals, and sometimes even crabs. I am experiencing great trouble from this creature in my small farm in South Malabar. These monkeys generally appear in gangs of 10 to 15 of all ages led by one or two hefty males which previously reconnoitre the area and lead the gang. The creatures destroy much more of the crop than actually use as food. The halo of sacredness attached to this creature as the 'Hanuman' or his kinsman and the consequent fear of becoming a sinner by killing him has helped it a good deal to multiply and carry on its injurious work in fields and gardens with impunity. Occasional shooting of one or two of them or trapping them in cages and transporting them far away beyond rivers or hill ranges will be found to give some relief. It may be added that in some countries monkeys are trained to gather fruits and nuts and help man. The langurs (*Semnopithecus*) or the bigger monkeys which have no cheek pouches and which make a loud howling noise generally infest only thickly wooded hill country and only confine their attacks to hill estates. The squirrels and rats are the chief representatives of the rodent mammals causing wide spread damage in various ways. The striped squirrel (*Sciurus palmarum*) is often found on all fruit trees and even steals grams and other food stuffs exposed for drying in the open. The damage done by rats, one of the most notorious and terrible pests among animals is too well known to receive any detailed record here. The commonest and most destructive of field rats is the southern mole rat (*Gunomys Kok* Gr). It attacks paddy, ragi, tapioca, lucerne, vegetables, and a variety of other cultivated plants. The domestic rat which belongs to one or two varieties of the (*Rattus* H), is a domestic pest all over S. India. The recent further notriety the rat has gained as the medium carrying the plague bacillus (*Bacillus pestis*) has added to our dread of this rodent pest not only as a field and domestic pest but as a disease carrier as well.

The injury caused to man and his belongings like crops, cattle etc. by such wild animals as the tiger, the leopard, the bear, the elephant, the wild pig, the porcupine are well known especially in areas adjacent to hills, and forests. In some parts of South Canara and Malabar elephants cause very serious damage to growing crops during certain seasons; one can easily imagine the nature of the damage caused when even one or two elephants spend a half hour or so in a banana, sugarcane, cardomamom, tea or coconut garden—The bear (*Melursus*) and the Porcupine (*Hystri*) are fond of roots and tubers; in addition the former is destructive to bee hives on trees and even to toddy pots in palms. The tiger, leopard and the cheetah are to be considered only as dangerous to the safety of man, cattle and poultry and not as crop pests. The toddy cat (*Paradoxurus*) is well known in South India as causing damage to palm trees and sometimes even to household things in dwellings near palm groves. The civet cat (*Viviera*) is a common creature found along the Malabar coast; it is however a beneficial

animal not only as an enemy of snakes and insects of sorts but also gives the civet, a secretion which has some commercial value. The Indian mungoose (*Herpests*) is also a beneficial creature having carnivorous and insectivorous habits; but it often attacks poultry. That bats are mammals, I am sure most of you are aware of; some of them are of economic importance both agriculturally and otherwise. Many of us are I believe familiar with the flying fox (*Pteropus*) which is sometimes found in thousands hanging from some big trees. The trees in which these roost are heavily loaded and completely hidden by hundreds hanging on to every branch. Very serious damage is caused by these creatures to all sorts of fruit trees for miles around their roosting tree. These are the biggest of bats and have faces like the fox, hence the name. There are species of smaller bats also some of which often fly about our houses feeding on mosquitoes and moths and doing some good work. Artificial enclosures known as "*Bat towers*" are made in some countries to give convenient homes to some of these bats and help their insectivorous activities especially mosquitoe feeding. Bat's dung or guano is also a very valuable manure used by fruit royetalle growers; I know that the melon growers of parts of Cuddappah use this stuff.

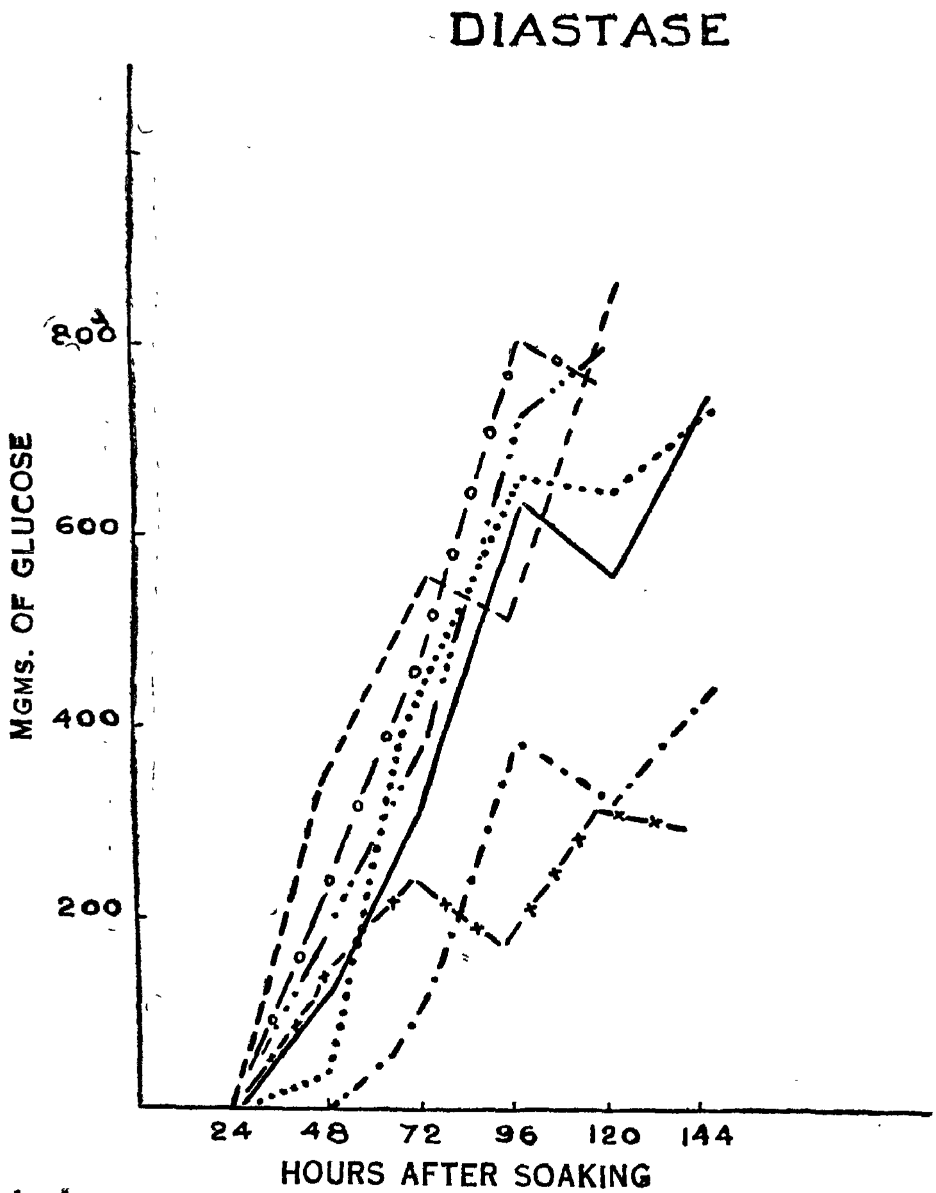
One member of the mammalian group the Pangolin or scaly ant eater (*Manis*) with a curiously plated body, a long prehensile tail and pointed snout is a very beneficial creature. It is nocturnal in habits and feeds on insects especially white ants the nests of which it tears open with its powerful claws. The economic zoology of the mammals includes besides the above groups which are of agricultural imporatance some others which have also begun to show great economic value; more important of these are the whales which give valuable substances like whale oil, whale bone, spermaceti, ambergris and guano; the seals which are hunted for their seal skin (Pelt) and oil and the fur bearing animals especially of the polar regions such as Weasels, artic fox, otter skun (Beaver etc.)

This concludes my necessarily brief survey of the various groups having relations to agriculture excepting the Arthropoda which I shall deal with next. Compared with the work done on the arthropoda, especially on the insects the agricultural zoology of other animal groups in India has received practically very little attention. I need hardly tell you that I have only touched the fringe of the subject. A good deal of further work awaits us in many branches especially in Helminthology, ornithology and mammalogy. I can only conclude this lecture by adding that intensive investigations on the food and breeding habits of many of these higher animals, their interrelations and their relations with members of the other groups of animals will add to our knowledge considerably and will help us to utilise to the best advantage the knowledge so gained, not only for agricultural purposes but also for several other needs of humanity.

Research Notes.

Diastatic Activity in Germinating Paddy.

Although the method of assessing the viability of seeds by their percentage germination has much to commend it on account of its simplicity of technique and convenience, it possesses certain defects—the chief of which is that it fails to give any indication of the vigour of the seedlings. As this latter is the true criterion of the fitness of any strain for propogation, any test, however empirical, which would furnish information on this aspect would be a valuable weapon



References :-

—— 1. In darkness.
– – – 2. In absence of CO_2
……… 3. In absence of CO_2 & O_2
-·-·- 4. In Excess of CO_2
—x—x— 5. In reduced pressure.
—o--o— 6. Submerged in 80 ccs. of water with 5 cc. of H_2O_2
—·-·-— 7. Soaked in Fusarium Extract throughout.

in the hands of the economic plant breeder. In recent years with the advent of the concept of vernalisation, great significance has been attached to the "germination" phase of plant development, and it is now well recognised that by appropriately treating the seed during germination the developmental phase can be profoundly modified. If it were possible to correlate the physiological activity during germination with vigorous after-growth, the geneticist would be saved much time and labour in plant selection.

With this object in view, an investigation was undertaken on the changes taking place when the paddy grain is allowed to germinate under a variety of controlled conditions. The individual role of embryo and endosperm and of the enzymes diastase, maltase and catalase have been studied. The accompanying graph shows the changes in the diastatic activity of the whole seed during germination under the condition studied. It will be seen that carbondioxide has a marked effect on diastatic activity. If germination is under water, the oxygen content and volume of water, and the degree of submergence influence enzyme activity. Growth-promoting substances cause a small increase of diastase.

The experiments, full details of which will be published shortly, show that growth as indicated by weight of seedlings or morphological measurements does not bear any strict relationship to the quantity of diastase produced during germination.

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ABSTRACTS

Preservatives for wooden and bamboo posts against ground-inhabiting termites. (*The Philipine Agriculturalist* Vol. XXV No. 8). In an attempt to find some cheap and effective preservative against the attack of termites which quickly destroy posts, fences, and other structures that are in contact with the soil, bamboo posts and ipil-ipil (leuciena Glanca) were treated with coal tar, salt and paris green. Two hundred grams of salt and about sixtyfive grams of paris green were put into the holes into which the posts were fixed. In the case of coal-tar, the parts of the posts to be set in the ground were dipped in coal tar. Controls were also run side by side.

All the three preservatives were found to be generally effective in wooden posts, salt coming with 66·7 % attack, followed by paris green ((70%) and coal tar (90%) on bamboo paris green showed 40 % attack, salt 60 % and coaltar 70 %.

Regarding the economics of the treatment, coal tar is the cheapest, in the cost of treatment being annas five ; followed by salt with annas ten for 100 posts Paris green treatment was prohibitively costly, as the figure came to about three annas and a half.

The fungicidal effect of salt and coal tar was not significant. In this, paris green was the most effective. K. S. R.

Broiler Factories by Philip-H. Smith. (*Scientific American*, 1937 pt. 12). The article deals with the mass production of eggs and broilers in the factories situated in the heart of cities. The growth of the factory idea may be gauged from the fact that there are more than 10,000 installations and that one hundred of the bird population of the United States has been thus caged. Poultry branch of the farm activities has been industrialised, moved bodily into heart of big cities and great economies in the matter of transport accomplished through the new system of 'battery brooding'. The birds are confined from the first day of their life in wire cages and pass through three stages of (1) starting (2) growing (3) developing. After the last stage the males are sold as broilers and females are carried to the fourth stage as egg layers. The number of birds is successively

reduced at each stage till the laying hen has a cage of her own. The eggs as soon as laid roll out of reach, are recorded and collected, and when the egg production falls below a standard, the birds are sold, and the places occupied by better workers. The arrangements are perfected so that no litter is scattered and no food or water is wasted. The lack of sunlight resulted in rickets and this was overcome by feeding with cod-liver-oil. The problem of cannibalism was overcome by a trick. Ruby coloured glass windows and coloured light bulbs solved the trouble. The cannibalism was suspected to be due to the sight of blood where the pin feathers came through the skin and the red light neutralised the effect. The freedom of the birds from soil and litter results in a disease-free condition. A controlled ventilating system is designed to give a plentiful oxygen supply to each bird. Prolonged tests have shown that under these controlled conditions of temperature, light and humidity, the seasonal fluctuations of a neutralised bird are eliminated. There is no scattering of rations and hence feed-cost is reduced. Under natural conditions 100 birds is the limit of bird density per acre and beyond which, it will breed diseases due to crowding. As an example of the efficiency of battery brooding, M. H. Arndt experimental plant houses 16,000 birds on less than one acre and all labour is performed by two men only. The revenue from the droppings amounts to roughly the cost spent on labour. The freshness of products and lower breakage losses due to reduction in the distance transported, are other points in their favour. Breeding for confinement-minded birds are being done and among other incentives tried music has been found to induce better laying. Attempts to make better use of the dropping as fertiliser are being made. The volatile products like ammonia of the litter are being captured by placing chemicals on the belts, and if successful will result in a better utilisation of the waste and by-products. The factory idea will be improfitable, if new structures are to be erected, but the establishment chiefly depends upon the ability to rent or purchase obsolete structures which do not posses any economical value for other enterprises. R. B.

Agricultural Jottings

BY THE DEPARTMENT OF AGRICULTURE, MADRAS

Cattle Breeding. A Dairyman or ryot who owns a herd of cows and supplies milk all the year round to his customers has to regulate the calving of his cows throughout the year to fulfil his orders and keep up a uniform supply. It is therefore important that he should know something about the "Oestrum" in cows or "the period of heat." This is the time when the cow calls for the bull.

A heifer will come on 'heat' for the first time any time from the age of 2 to 4 years according to the state of her maturity, condition, environment and feeding, i.e., an early matured heifer reared under good conditions will take the bull much earlier than one which is underfed and undersized. In temperate climates, cows come on heat about 3 weeks after calving and every 3 weeks after that until they conceive; but in India, the indigenous cows vary from 3 weeks to a year or more after calving and their periods are very irregular. On the average the Indian cow in good condition will conceive about 3 to 4 months after calving. Some people are under the impression that a cow will conceive at any time if covered by the bull. This is not so, a cow must be properly "on heat" if she is to conceive. It is therefore waste of time taking her to the bull unless she shows the signs of "Oestrum."

It is very easy to see how a heat period in a cow might easily be missed. There are often no apparent preliminary symptoms of approaching heat, such

as are observable in the bitch. which bleeds extensively for several days (pre-oestrum). External haemorrhage in the cow or heifer, if it occurs at all, does so 2 or 3 days after the beginning of the heat. This is far more common in heifers than cows; in the latter it is rare, but in heifers the appearance of blood-stained mucus at the vulva is quite frequent; it forms a useful indication as to when the animal may be again on heat. On the average, heat lasts about 16 hours in heifers and 19 hours in cows. In the cold season a heat period may only last 6 hours as against 16 or more hours in hot season. It is easy to see therefore, that a period occurring in the night is overlooked. Again it is more difficult to detect the heat when the cow is tied in the stall than when she is allowed to run about.

In some cases ryots will not allow their cows to be taken to the bull whilst they are in milk and suckling their calves in the belief that if the cow is served by the bull, the cow will immediately go dry. This is not so; the cow will continue to yield milk if properly fed.

The following signs of "Oestrum" in cows will benefit cow owners in discovering the proper time to send their cows to the bull.

(i) The cow will be restless and will switch its tail frequently from side to side and will turn her head towards its hind quarters.

(ii) It will go off its feed for a day or so.

(iii) The external genital organ (vulva) will be slightly swollen and there will be a slight discharge of a white slimy mucus.

(iv) It will stand with its tail raised and ears erect and will stare at individuals.

(v) Frequent passing of urine.

(vi) Milk yield will decrease for 2 or 3 days and does not allow calf to suckle properly.

(vii) If tied in a stall, will be restless and will bellow frequently.

(viii) If allowed to graze or exercise with other cows, she will be seen to jump on them or allow others to hump her.

All cows should be taken to the bull immediately these signs appear. It is no use waiting until the next day as this may be too late.

The above symptoms become more pronounced in an adult cow than in a heifer or first calving cow.

Breeding Bulls and their Management. There are occasional complaints that some breeding bulls are slow servers and others refuse to serve at all. It is therefore necessary that the agriculturists should be informed of some of the reasons why this happens.

1. Slowness of service is not necessarily an indication of infertility. It is true, however, that they are often associated and notably so in animals which are too fat or alternatively, in those which are going back in condition. The best condition for breeding in males is a hard one produced by sufficient exercise to work off a surplus of fat, but favouring the retention of nitrogenous substances and vitamins. However it cannot be sufficiently stressed that with the male, as well as with the female, a rising condition is always more conducive to the proper discharge of the reproductive functions than a falling one. A breeding bull can be worked for half a day in a single bullock cart or can be used as a work animal in agricultural operations. The bull should be well fed and given green fodder whenever available, its muscles should be fairly hard and there should be very little fat on its body; but do not allow it to lose condition and become too lean. Groom it daily and pick off all ticks as these reduce its vitality and irritate it.

2. Slowness in service is sometimes psychical in nature due to strange surroundings or to the nature of the control to which the animal is subjected. Hesitation in service is also sometimes the result of sores or warts on the prepuce, penis or feet and males are in best condition for service a few hours after they have been fed when they are more active than directly after a meal. It is sometimes noticed that stud animals which have travelled long distances and are introduced into fresh surroundings are temporarily infertile, especially when the new conditions are less favourable than those to which the animals have been accustomed. This, however, is usually only a temporary result and full fertility can generally be restored by favourable treatment in the way of diet and surroundings. When a new bull is purchased and brought to the homestead, feed it on the same ration, if possible, as it was formerly fed on, allow it time to become accustomed to its new surroundings and do not ill-treat it. House it in a comfortable shed, give plenty of exercise as stated above and allow it to rest for two or three weeks before it begins its service.

3. It is of great importance that a male animal should be used regularly. It should not be used too much at one time and too little at another. It should be remembered also that prolonged periods of disuse may be as injurious to the bull as over-use since undue accummulation of semen in the generative passages may result in back pressure and deleteriously affect the spermogenetic capacity of the testes and possibly also interfere with the functional activity of the accessory sexual glands. In India this is difficult as a large nnmber of cows come on heat after the rains and when good grazing is available and breeders are apt to permit the bull to perform too many services in a short period. This is undesirable; the number of services in a month should be limited to 10 or 12 at the most in these heavy seasons. If possible the services should be spread out evenly throughout the year.

4. With any young males it is inadvisable to allow service to occur too often, even though the service may be fertile, as frequent service, when performed too early, is likely to result in undergrowth of the sire and to impair its breeding capacity in later life. Young males are most liable to suffer from underfeeding and over-use. whereas old males suffer from overfeeding and under-use. Many young early matured bulls are ready for work at 2½ years old but as the bull is not fully grown until about 4 years old, its services from 2½ to 3 years should be limited to 3 per month, from 3 to 4 years to 4 per month or 50 in the year. If a young bull is allowed to serve a great number of cows in its early life, the length of its breeding life will be considerably reduced. See that a young bull is well-fed and kept growing. It the case of matured bulls, the rations can be decreased if it is seen that they are becoming fat.

5. In general, the males of the lighter breeds are able to serve more females successfully than those of the heavier breeds. Kangayam and Hallikar bulls are much quicker at service than the bulls of the heavier breeds such as the Ongoles and Sinds.

6. Onanism or sexual abuse is sometimes a source of trouble, more especially in young animals that are given little service. This is often seen in India and to avoid it as far as possible, give the bull some hard work to do if there are no services to perform.

A bull will refuse to serve a cow which is not properly in heat and will not stand. This is a very common complaint unnecessarily made against the bull. It must be remembered that the period of heat (Oestrum) in cows only lasts for about 16 hours and it is essential that the cow shonld be taken to the bull at once before the heat subsides; otherwise the cow will not stand and the bull will not serve it.

Crop & Trade Reports.

Receipt of raw cotton at press and spinning mills.

Total cotton presaed and unpressed.

	Bales of 400 lbs. against an estimate of 540.700 bales for 1935-36.	Figures for corresponding period in the previous years.
1—2—36 to 8—1—37	621,566	466,742
1—2—36 to 15—1—37	626,009	470,479
1—2—36 to 22—1—37	629,854	473,234
1—2—36 to 29—1—37	635,700	478,597
1—2—36 to 31—1—37	636,151	478,597
	Bales of 400 lbs. against an estimate of 412,000 bales for 1936-37.	
1—2—37 to 5—2—37	2,064	4247
1—2—37 to 12—2—37	6,314	8033

	Cotton bales received at mills.	Exported by Sea.	Imported by Sea.
1—2—36 to 8—1—37	399,245	264 552	101,217
1—2—36 to 15—1—37	403,381	265,634	101,315
1—2—36 to 22—1—37	409,714	268,661	101,673
1—2—36 to 29—1—37	418,329	27 ,202	107,307
1—2—36 to 31—1—37	420,185	274,389	108,564
1—2—37 to 5—2—37	2,524	821	1,438
1—2—37 to 12—2—37	6,741	1,531	1,447

Statistics—1936—37—Cotton—Fourth forecast report. The average of the areas under cotton in the Madras Presidency during the five years ending 1934—35 has represented nine per cent of the total area under cotton in India.

The area under cotton up to the 25th January 1937 is estimated at 2.461,400 acres. When compared with the area of 2,601,400 acres estimated for the corresponding period of last year, it reveals a decrease of 5·4 per cent.

479,300 acres have been reported as sown since the last December forecast was issued. This extent is made up of 253,400 acres under Tinnevellies, 99,900 acres under Cambodia, 87,500 acres under Northerns and Westerns, 32,200 acres under Salems, 8,100 acres under Cocanadas and 1,200 acres under other varieties of cotton. The area sown in December and January exceeds that sown in the corresponding period of the previous year by 78,800 acres or by 19·7 per cent.

The decrease in area in the current year as compared with the area in 1935—36 occurs in all the important cotton growing districts outside East Godavari, Anantapur, Coimbatore and Madura. In the Deccan, the area fell from 1,221,700 acres to 1,048,500 acres i.e. by 14·2 per cent owing to want of timely and sufficient rains.

The area under irrigated cotton mainly cambodia is estimated at 247,600 acres as against 266,400 acres for the corresponding period of last year, a decrease of about seven per cent.

Pickings of the *mungari* or the early sown cotton crop in the Deccan have concluded. The yield was below normal.

Yields below normal are reported from the Cocanadas tract and the northerns and westerns tract and from Salem and Trichinopoly.

The seasonal factor for the Presidency works out to 96 per cent of the average as against 94 per cent for the corresponding period in the previous year. On this basis, the total yield is estimated at 533,100 bales of 400 lbs. lint as

against 545,000 bales for the corresponding period of last year. It is however, too early to estimate the yield with accuracy as the harvest has not yet commenced in the major portion of the area and much will depend upon the future weather conditions and the toll taken by insect pests.

The estimated area and yield under the several varieties are given below : (Area in hundreds of acres, i.e. 00 being omitted; yield in hundreds of bales of 400 lbs. lint i e. 00 being omitted)

Variety.	Area from 1st April to 25th January		Corresponding yield	
	1936-37. Acs.	1935-36. Acs.	1936-37. Bales.	1935-36. Bales.
Irrigated cambodia	2,352	2,528	1,455	1,531
Dry cambodia	2,765	3,115	594	668
Total cambodia ...	5,117	5,643	2,049	2,199
Karunganni in Coimbatore ...	1,284	1,366	293	297
Uppam in the Central districts ...	356	336	55	53
Nadam and Bourbon	177	33	9	2
Total Salems ...	1,817	1,735	357	352
Tinnevellies*	5,644	4,806	1,454	1,238
Northerns and Westerns ...	10,485	12,240	1,199	1,389
Cocanadas	1,459	1,509	260	263
Others	92	81	12	9

* Includes uppam, karunganni and mixed country cotton in the South.

The wholesale price of cotton lint per imperial maund of 82 2/7 lbs. as reported from important markets on the 1st February 1937 was Rs. 19—12—0 for Cocanadas, Rs. 19—0—0 for early crop westerns, Rs. 19—7—0 for late crop westerns, Rs. 25—5—0 for Cambodia, Rs. 25—6—0 for Coimbatore Karunganni and Rs 21—13—0 for Nadam cotton. When compared with the corresponding prices towards the close of December 1936, the prices reveal a rise of about 3 per cent in the case of Coimbatore-karunganni and a fall of about 2 per cent in the case of cambodia while the prices of Cocanadas, Westerns (early crop) and Nadam are stationary.

Statistics—Paddy—1936—37--Final forecast report. The average of the areas under paddy in the Madras Presidency during the five years ending 1934—35 has represented 13·4 per cent of the total area under paddy in India.

The area sown with paddy in 1936—37 is estimated at 9,796,000 acres as against 9,615,000 acres for the corresponding period of last year and the finally recorded area of 9,796,280 acres in 1935—36. The present estimate is practically the same as the final area of last year but falls short of the area of 9,999,000 acres in an average year by 203,000 acres or by two per cent.

1,292,000 acres have been reported as sown since the last December forecast was issued. The extent so sown was large in the East Godavari, West Godavari, Anantapur, Nellore (110,000 acres) Chingleput (88,000 acres) South Arcot (93,000 acres), Chittoor and North Arcot (90,000 acres in each), Tanjore, Madura, Ramnad (200,000 acres) and Tinnevelly (115,000 acres). The area sown in December and January was greater than that sown in the corresponding period of last year by 87,000 acres or by 7·2 per cent.

The area under second crop paddy is expected to be below normal.

The harvest of paddy is in progress.

The yield is expected to be slightly above normal in Vizagapatam normal in East Godavari, Kistna, Kurnool, Cuddapah, the South, the West Coast and the Nilgiris, and below normal elsewhere, notably in Chingleput where it is estimated to be only 85 per cent of the normal. The seasonal factor for the Presidency works out to 98 per cent of the average as against 99 per cent in the season and crop report of last year. On this basis, the yield works out to 94,322,000 cwt. of cleaned rice. This represents a decrease of 494,000 cwt. of cleaned rice or 0·5 per cent when compared with the estimate of 94,816,000 cwt. of cleaned rice in the Season and Crop Report of last year. The yield in an average year is estimated at 98,676,000 cwt. of cleaned rice.

The wholesale price of paddy per imperial maund of 82 2/7 lb. as reported from important markets on the 8th February 1937 was Rs. 2—9—0 in Nellore, Rs. 2—3—0 in Guntur and Madura, Rs. 2—2—0 in Bezwada and Masulipatam, Rs. 2—1—0 in Ellore, Rs. 2—0—0 in Rajahmundry, Rs. 1—15—0 in Cuddalore and Tinnevelly, Rs. 1—14—0 in Cocanada and Trichinopoly, Rs. 1—13—0 in Mangalore, Rs. 1—12—0 in Kumbakonam and Rs. 1—8—0 in Negapatam. When compared with the corresponding prices towards the close of December 1936, the prices reveal a fall of 14 per cent in Negapatam, 13 per cent in Madura, 10 per cent in Rajahmundry, 9 per cent in Cocanada, 8 per cent in Trichinopoly, 5 per cent in Tinnevelly, 4 per cent in Kumbakonam, and Nellore, 2 per cent in Masulipatam and 1 per cent in Bezwada.

Statistics—Crop—Sugarcane 1936—Third or Final Report. The average of the areas under sugarcane in the Madras Presidency during the five years ending 1934—35 has represented 3·6 per cent of the total area under sugarcane in India.

The area planted with sugarcane up to the 25th December 1936 is estimated at 121,530 acres. When compared with the area of 118,520 acres estimated for the corresponding period of last year, it reveals an increase of 2·5 per cent. The estimate of the previous year was less than the final area of 121,066 acres by 2·1 per cent.

The present estimate of area exceeds the second forecast by 11,840 acres. The excess occurs mainly in Vizagapatam, East Godavari, Bellary, South Arcot, Chittoor, Salem and Coimbatore.

The increase in area in comparison with the final forecast of 1935 occurs in all districts outside Kistna, Guntur, Nellore, South Arcot, Salem, Coimbatore, Trichinopoly, Madura, Ramnad, Tinnevelly and Malabar.

The harvest has just commenced and yields below normal are expected in all districts outside Vizagapatam, East Godavari, West Godavari, the Deccan (Bellary excepted), Ramnad, Tinnevelly and South Kanara where the yield is expected to be normal and in Salem where it is expected to be above normal by 10 per cent. The seasonal factor for the Presidency is calculated at 97 per cent of the average as in the previous year. On this basis, the yield is estimated at 338,790 tons of jaggery as against 328,770 tons estimated in January 1936, as increase of per cent. The final estimate for 1935—36 was 348,760 tons.

The wholesale price of jaggery per imperial maund of 82-2/7 lb. as reported from important markets towards the close of December 1936 was Rs. 7—7—0 in Madura, Rs. 5—12—0 in Tuticorin, Rs. 5—9—0 in Nandyal, Rs. 5—4—0 in Kumbakonam, Rs. 5 in Calicut, Rs. 4—15—0 in Bezwada, Rs. 4—12—0 in Masulipatam, Rs. 4—8—0 in Mangalore, Rs. 4—5—0 in Coimbatore, Rs. 4—4—0 in Rajahmundry, Rs. 3—15—0 in Cuddapah, Rs. 3—11—0 in Bellary and Salem, Rs. 3—10—0 in Cocanada, Rs. 3—4—0 in Trichinopoly, Rs. 3—2—0 in Vellore and Rs 2—14—0 in Vizagapatam. When compared with the prices in November 1936, these prices reveal a rise of 29 per cent in Madura, 21 per cent in Tuticorin, 15 per cent in Vizagapatam 13 per cent in Cuddapah, 7 per cent in Calicut and 6 per cent in

Kumbakonam and a fall of 24 per cent in Rajahmundry, 11 per cent in Salem and 8 per cent in Mangalore, whilst they remained stationary in the other centres.

Statistics – Crop—Groundnut—1936—Fourth or Final Report. The average of the areas under groundnut in the Madras Presidency during the five years ending 1934—35 has represented 45·4 per cent of the total area under groundnut in India.

The area sown with groundnut in the Presidency in 1936 is estimated at 3,426,500 acres. When compared with the corresponding estimate of 2,480,500 acres for the previous year and the actual area of 2.519,965 acres according to the Season and Crop report of the previous year, the present estimate reveals an increase of about 38 per cent and 36 per cent respectively. The estimated area for this year. exceeds the average area of 3,268,550 acres by 4·8 per cent. The areas reported in respect of Vizagapatam, West Godavari, Kistna and Malabar districts are the highest on record.

The increase in area is general outside Tinnevelly and is marked in the Deccan (+ 476.900 acres).

The harvesting of the summer and early crop of groundnut had concluded by the end of October. The harvesting of the winter or main crop is proceeding.

The crop is expected to be above normal in Kistna (125 per cent), normal in Vizagapatam, East Godavari, Chittoor, Coimbatore, Ramnad and Tinnevelly and below normal in the other districts notably in Trichinopoly. where it was affected by drought and caterpillar attack and the seasonal factor was reduced in consequence to only 75 per cent of the normal which is about the lowest reported in recent year. The seasonal factor for the Presidency works out to 94 per cent of the average as against 95 per cent in the previous year according to the Season and Crop report. On this basis, the yield is expected to be 1,652,200 tons of unshelled nuts as against 1,201,860 tons in the previous year, an increase of 37·5 per cent. The yield in an average year is estimated at 1,636,390 tons.

The wholesale price of groundnut shelled, per Imperial maund of 82-2/7 lb. as reported from important markets towards the close of December 1936 was Rs. 6-5-0 in Cuddalore, Rs. 6-1-0 in Cocanada, Rs. 6-0-0 in Vizagapatam, Rs. 5-14-0 in Negapatam, Rs. 5-10-0 in Cuddapah, Rs. 5-9-0 in Guntur, Rs. 5-8-0 in Vizianagram and Nandyal, Rs. 5-7-0 in Vellore, Rs. 5-6-0 in Bellary, Rs. 5-3-0 in Salem and Rs. 4-3-0 in Tinnevelly. As compared with the prices for October 1936, these prices reveal a rise of 21 per cent in Nandyal, 15 per cent in Cuddapah 10 per cent in Vizagapatam and Vellore, 6 per cent in Cuddalore, Salem and Negapatam and 5 per cent in Vizianagram and a fall of 3 per cent in Cocanada whilst they remained stationary in Guntur and Tinnevelly.

Statistics—Crop—Gingelly—1936—37—Third Report. The average of the areas under gingelly in the Madras Presidency during the five years ending 1934—35 has represented 11·6 per cent of the total area under gingelly in India.

The area sown with gingelly up to the 25th December 1936 is estimated at 511,900 acres. When compared with the area of 449,100 acres estimated for the corresponding period of last year, it reveals an increase of about 14 per cent.

The increase in area is general outside West Godavari, Kistna, Kurnool, Nellore, Trichinopoly, the South (except Tanjore) and South Kanara. The increase is marked in Vizagapatam (+37,000 acres) and Chingleput (+11,400 acres).

The main crop has been harvested except in the south where the harvest is in progress. The crop suffered from drought to some extent and the yield is reported to be below normal except in Kistna, Guntur, Kurnool, Cuddapah, Nellore, Tanjore, Ramnad, Tinnevelly and South Kanara.

The seasonal factor for the Presidency works out to 91 per cent of the average as against 92 per cent for the corresponding period of last year. On this

basis, the yield is estimated at 62,800 tons as against 55,900 tons for the corresponding period of last year, an increase of about 12 3 per cent,

Statistics—1936—Pepper Crop—Final Report. The area under pepper in 1936 in the districts of Malabar and South Kanara is estimated at 94,000 acres in Malabar and 8,500 acres in South Kanara as against the final area of 89,453 acres in Malabar and 8,528 acres in South Kanara in the previous year.

The condition of the crop is generally fair. The early outbreak of the south-west monsoon affected the flushing of the crop to some extent and there was shedding as usual. The seasonal factor is estimated at 90 per cent of the average in Malabar and 95 per cent in South Kanara as against 90 per cent in each district in the previous year. On this basis, the yield is estimated at 12,700 tons for Malabar and 1,210 tons for South Kanara as against 12,200 tons for Malabar and 1,150 tons for South Kanara estimated in the previous year.

The wholesale price of pepper per imperial maund of 82-2/7 lb. as reported from important markets towards the beginning of January 1937 was Rs. 16—10—0 in Calicut, Rs. 17—7—0 in Tellicherry and Rs. 18—3—0 in Mangalore. As compared with the prices in August 1936, these prices have risen by about 33 per cent in Calicut, 49 per cent in Tellicherry and 38 per cent in Mangalore.

Statistics-1936-Ginger Crop-Final Report. The area under ginger in 1936 is estimate at 10,000 acres in Malabar as against the actual area of 9,913 acres in the previous year.

The yield is estimated to be normal as against 80 per cent of the normal in the previous year. On this basis, the total yield is expected to be 3,580 tons of dry ginger as against 3,370 tons in the previous year.

College News & Notes.

Students' corner. During the first week of February Rao Sahib Dr. T. V. Ramakrishna Iyer B. A. Ph. D. delivered the Maharaja of Travancore Curzon lectures for 1936—37, on "Agricultural Zoology" when Mr. R. C. Broadfoot the Principal of the college presided.

Club day celebrations. The twentyeighth club day of the Agricultural College students' club was celebrated on 27th February 1937 with M. A. T. Coelho Esq., B. A. B. L. Additional Sessions Judge, Coimbatore, in the chair.

After a light tea and fancy dress competeton guests and members adjourned to the Freeman Hall. After the annual reports were read the various prizes were distributed by Mrs. Coelho. Then the guests were entertained by the members. This was followed by the presidential address. Mr. Coelho dwelt upon the value of club life. With a vote of thanks by Mr. R. C. Broadfoot the pleasant function came to an end.

Economic Biologists Assosiation. Under the auspices of the above association Rao Bahadur M. R. Ramaswamy Sivan, retired principal of the college, delivered an interesting lecture on Malayan Agriculture.

Officers' Club Under the auspices of the club Rao Bahadur M. R. R. Sivan gave a very lively talk on his visit to Malaya. He gave a very vivid description of the places he visited, of the men and things he saw and of the social life obtained there.

Mr. K. Ramiah was entertained at tea on the eve of his departure for Indore.

Weather Review (JANUARY 1937.)

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·0	-0·2	0·0
	Berhampore*	0·0	-0·4	0·0
	Calingapatam	0·0	-0·3	0·0
	Vizagapatam	0·0	-0·5	0·0
	Anakapalli*	0·0	-0·3	0·0
	Samalkota*	0·0	-0·1	0·0
	Maruteru*	0·0	0·0	0·0
	Masulipatam	0·0	-0·2	0·0
	Cocanada	0·0	0·2	0·0
	Guntur*	0·0	0·0	0·0
Ceded Dists.	Kurnool	0·0	-0·2	0·0
	Nandyal	0·0	-0·1	0·0
	Hagari*	0·0	0·0	0·0
	Bellary	0·0	-0·1	0·0
	Anantapur	0·0	-0·4	0·0
	Rentachintala	0·0	...	0·0
	Cuddapah	0·0	-0·4	0·0
	Anantharajupet*	0·0	...	0·0
Carnatic	Nellore	0·0	-1·7	0·0
	Madras	0·1	1·3	0·1
	Palur*	1·5	-0·2	1·5
	Tindivanam*	0·4	-0·6	0·4
	Cuddalore	1·6	-0·0	1·6
Central	Vellore	0·2	-1·3	0·2
	Salem	0·0	-0·3	0·0
	Coimbatore	0·0	-0·6	0·0
	Coimbatore Res. Inst.*	0·0	-0·5	0·0
	Trichinopoly	0·3	-0·4	0·3

Division	Station	Actual for month	Departure from normal @	Total sin January
South	Negapatam	4·4	2·7	4·4
	Aduthurai*	0·3	-3·6	0·3
	Madura	0·1	-0·5	0·1
	Pamban	3·9	1·8	3·9
	Koilpatti*	0·5	-1·0	0·5
	Palamkottah	1·9	0·4	1·9
West Coast	Trivandrum	1·2	0·5	1·2
	Cochin	0·4	-0·3	0·4
	Calicut	0·0	-0·4	0·0
	Pattambi*	0·0	-0·3	0·0
	Taliparamba*	0·0	-0·2	0·0
	Kasargode*	0·0	-0·2	0·0
	Nileshwar*	0·0	-0·3	0·0
	Mangalore	0·0	-0·1	0·0
Mysore and Coorg	Chitaldrug	0·0	-0·3	0·0
	Bangalore	0·1	...	0·1
	Mysore	0·0	-0·2	0·0
	Mercara	0·0	-0·2	0·0
Hills.	Kodaikanal	0·9	0·2	0·9
	Coonoor*	1·1	...	1·1
	Ootacamund*	0·3	-0·6	0·3
	Nanjanad*	0·2	-1·1	0·2

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 (published in Fort St. George Gazette).

Eight fresh western disturbances entered the country during the month, many of them causing falls of rain or snow in Kashmir, Punjab, Baluchistan, North West Frontier Province and the hills of the United Province.

During the first half of the month local rain were reported from South East Madras on 1st, 2nd and 13th to 16th and from extreme south of the Peninsula on 7th. During the second half dry weather conditions prevailed in South India and other parts of the country except for falls of snow or rain in North West India., due to western disturbances and scattered thundered showers in Assam and Tennassim.

Rainfall was in defect through out this Presidency and in Mysore.

Weather Report for the Research Institute observatory.

Absolute Maximum in shade	...	90·5 F.
Absolute Minimum in shade	...	57·8 F.
Mean Maximum in shade	...	86·0 F.
Departure from Normal	...	Nil.
Mean Minimum in shade	...	64·0 F.
Departure from normal	...	- 0·40 F.
Total rainfall	...	0·03"
Departure from normal	...	- 0·45"
Heaviest fall in 24 hours	...	0·03
Total number of rainy days	...	Nil.
Mean daily wind velocity.	...	1·5 M.P.H.
Mean humidity at 8 hours	...	72·8%
Departure from normal	...	- 2·7

Summary. Dry weather prevailed during the month. Rainfall was in defect by 0·45". Day temperature remained normal. Humidity was in defect by 2·7%.

Departmental Notifications.

Transfers and Postings. Mr. M. Narayana Iyer, A. D. Jammalmadugu to IV circle. Mr V. Visvanatha Iyer, A. F. M. C. F, Coimbatore to IV circle; Mr. Edwin Amirtharaj Prob A. D. Ramnad to be A. D. Manamadura; Mr. K. M. Jacob, A. D. Palghat to be F. M. Taliparamba; D. V. Krishna Rao, Asst. to G. A. C. to to be junior asst. for soil survey work in the Gundalakama Project.

Leave. A. Kondiah Sarma, A. D. Naraspur, l. a. p. on m. c. for 3½ months from 14 - 2 - 37; Mr. Alur Vengobachar A. A. D. Van duty l. a. p. for one month from 2 - 2 - 37; Mr. K. Krishna Menon, Assistant, Mycology Section, Coimbatore l. a. p for one month and 16 days from 8 - 2 - 37 with permission to avail the holidays from 23 - 3 - 37 to 30 - 3 - 37; Mr. S. Viravaradharaju, A. D. Co. 2 Scheme l. a. p. for one month from 5 - 2 - 37; Mr. P. S. Suryanarayanamurthi, Assistant Mycology, Aduthurai l. a. p. for one month from 24 - 2 - 37. Mr. B. S. Narasimha Iyer, Chemistry Assistant, Coimbatore l. a. p. for two months on m. c. from 5th March 1937; Mr. A. Krishnaswamy Iyer, A. D. Kurnool l. a. p. on m. c. for six months from 26 - 2 - 37.

Madras Agricultural Journal

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Editorial.

Review of the Work of the District Economic Councils. The Government have recently reviewed the work done by these councils during the quarter ending 31st December 1936. We are gratified to read there that 'the progress so far made is encouraging. The councils in most districts have completed or nearly completed the preliminaries necessary for starting work and a few councils have started some work.' We also note with satisfaction that during the period under review, a few councils have arranged for the training of persons in veterinary matters, in maternity and general rural reconstruction work, while many others have in addition carried out actual improvements in rural education, sanitation and water supply. It is also claimed that as a result of these endeavours, a desire to improve has been roused amongst the villagers—a really most encouraging feature for the future and a valuable *sinequanon* of the success of the present drive for rural uplift.

The Government have, while recognising the difficulties involved, stated that the villagers should be prepared to tax themselves if the improvements that have been initiated so far, and those that will be planned in the future were to prove to be of lasting benefit. While agreeing entirely to this useful dictum, we may state that the Indian ryot, with his age long traditions to contribute to the village funds for the maintenance of temples, festivities, and recreations, and for the repairs of tanks, wells and buildings, will quickly appreciate the justness of a levy for the continuance of beneficient activities of the present organisations. We wish however, to point out that advantage may be taken of the existing knowledge on the present position of these ancient village systems. In most villages these methods have fallen into disuse because of the loss of regard for the verdict and the experience of the village elders, and of the unwholesome increase of absentee landholders who generally take no interest in the village welfare. More important than either of these is the fact that the margin of savings from the agricultural incomes has become reduced to a nearly vanishing point.

If therefore any levy were to meet with adequate response, it is essential that programmes that aim at increasing the income of the cultivator must be set on foot in preference to works in other directions. It appears to us that greater importance should be attached

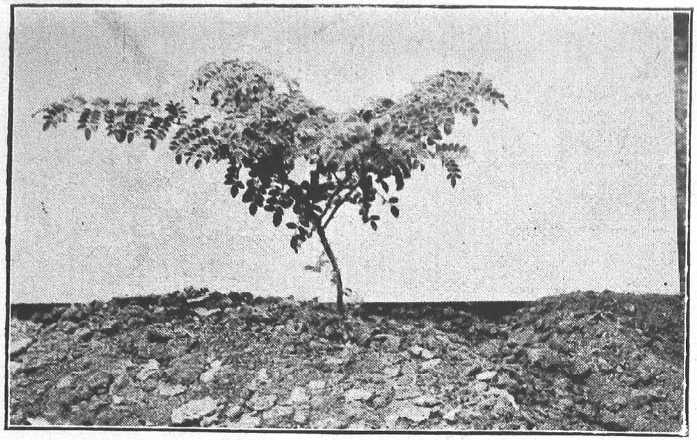
to items like making of composts introduction of high yielding crop varieties, development of fruit cultivation and of bee and poultry keeping, improvement of marketing methods, and the encouragement of cottage industries. Apart from these, early and efficient arrangements will have to be made to stop the drain of wealth from the village to the courts and money-lenders. We are sure that when the villager begins to enjoy the fruits of these endeavours, he will only be too glad to subscribe and thus pave the way for further work. We are afraid that till that stage is reached, voluntary contribution will not flow on a scale we wish to have. We should suggest as an alternative that a tax on agricultural incomes in each village above a certain minimum may be thought of for the development of the much needed work of rural reconstruction.

Training of farmers' sons in practical agriculture. In the July issue of this journal we referred to the Government's approval of a short course of training in practical agriculture to be given to 150 youths chosen from agricultural families. The scheme was primarily designed with a view to relieve unemployment amongst the educated and at the same time to direct their attention into activities which will be beneficial both to them and the country. It was therefore hoped that it would attract a large number of applicants.

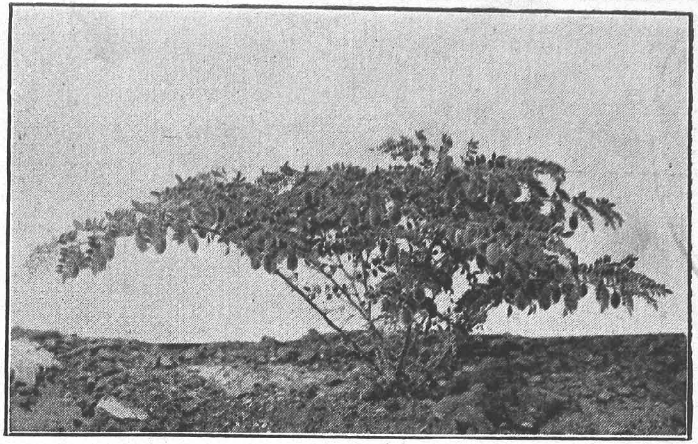
We understand that the response from the above class had not been in some places as good as expected and that even those that turned up did not take kindly to the course. Among the several probable causes that may readily be ascribed to this turn of events, the more important appear to be that these men coming as they do with no experience of manual work, naturally evince certain disinclination to hard field work generally expected of tillers of soil. They moreover, do not seem to possess even rudimentary knowledge of the local conditions of crops or croppings and as such find it difficult to fit themselves up into the short course and to study intensively the aspects that will be useful to them later on their own farms. It seems to us that if greater stress were laid, at the time of selection of candidates for training, to the nature of agricultural experience they have had on their farms, this drawback would be easily got over and the success of the scheme would be better assured.

We would also urge in this connection that business aspect of farming has to be instilled in their minds at each stage of cultivation and that maintainence of complete costings of all operations and their later scrutiny are essential for their ultimate success. The students may in addition be made to visit, in company with the departmental officers, typical villages where high grade farming is practised. We feel sure that such visits will put them in personal contact with successful farmers and will create in them greater confidence and resourcefulness in their later life as agriculturists.

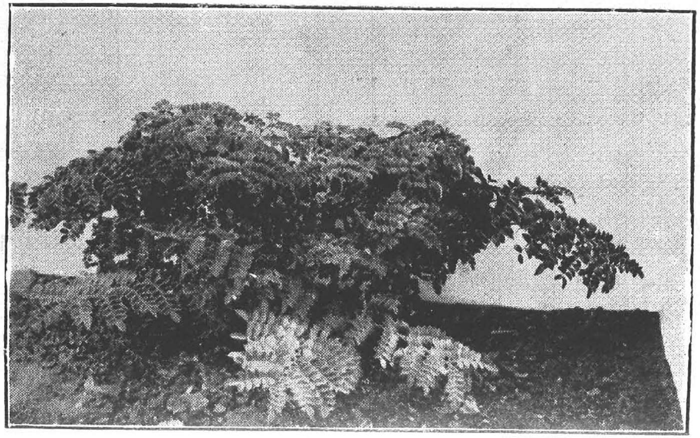
Plate I.



Strain 19



Strain 468



F. 1 of (19×468)

INHERITANCE OF BRANCHING HABIT IN GRAM (*CICER ARIETINUM*)

By V. RAMANATHA AYYAR,
and
R. BALASUBRAMANIAM,
(*Cotton Breeding Station, Coimbatore.*)

Among the several types of gram (*Cicer arietinum*) raised on the Cotton Breeding Station, Coimbatore, two distinct differences in the method of branching were noticed. One type had no axillary branches till about the ninth node but had higher up strong laterals with the result that well developed plants assumed the form of an open umbrella. In the other, secondary branches occurred even from the ground level, which in their turn quickly developed equally strong tertiaries (Plate I). Both types were found to breed true. There was practically very little variation from season to season and when found, it was within narrow limits. The types isolated by the Economic Botanist, Pusa, generally exhibited greater branching tendencies as would be noted in the accompanying table against Pusa types T. 6 and T. 8.

With a view to study their mode of inheritance, the umbrella-shaped type (No. 19) isolated from the local variety was crossed with three strains with branching habit *viz.* one (No. 468) from the local and the other two (T. 6 and T. 8) from Pusa types. The F_1 plants showed dominance in the basal branching character. In the F_2 there was a clearcut segregation conforming to a simple monohybrid ratio (vide table on the reverse). It might be mentioned that in the case of the cross 468 × 19, the number of basal branches in each plant was not counted in the F_2. They were only classified into branching and non-branching categories. Their F_3 progenies were however, studied in greater detail; and the mode of behaviour was quite in agreement with the expected ratios confirming that only a single pair of factors was responsible for the differences noticed in their phenotypic expression. These were designated by the symbols Br-br.

The higher range noticed in the Pusa types seems to be influenced by modifying factors. These are being studied.

That habit in plants is controlled by a single pair of genes has been observed by Shull (1908) in *Helianthus annus* and by Abe' (1919) in *Sesamum indicum*. The data presented here form another instance along that line.

Reference.

Abe' (1919). Preliminary note on inheritance studies of some characters in *Sesamum indicum*. Bot. Abst. 3, pp. 303.

Shull, G. H. (1908). Some new cases of Mendelian inheritance. Bot. Gaz. 45, pp. 103.

The junior author is employed in the Madras Herbaceum Scheme financed by the Indian Central Cotton Committee, Bombay. Thanks are due to the Committee for permitting him to make these studies during the off season.

Table.

Parents.	Generation.	Parental branching habit.	Number of families studied.	Actual number of plants in: Branched: No. of basal branches: 1	2	3	4	5	6	7	Total branched.	Non-branched.	Total number of plants.	Expected ratio.	Value of P.
19	...	...	...	...	...	...	...	...	...	...	...	30	30	...	...
T. 6	...	...	...	9	10	9	10	13	12	6	69	...	69	...	...
T 6×19	F_1	...	...	9	2	...	5	...	...	...	16	...	16	...	...
,,	F_2	Branched	10	152	162	63	12	5	1	1	396	142	538	3 : 1	>0·70
T. 8	...	...	...	11	13	7	6	10	6	10	63	...	63	...	...
T. 8×19	F_1	...	...	2	1	1	...	...	...	...	4	...	4	...	...
,,	F_2	Branched	4	69	73	43	4	4	...	...	193	65	258	3 : 1	>0·90
468	...	...	...	32	15	...	...	...	...	...	47	...	47	...	...
468×19	F_1	...	...	...	...	Not counted.			...	...	1	...	1	...	...
,,	F_2	Branched	1	...	...	Not counted.			...	...	72	27	99	3 : 1	>0·50
,,	F_3	,,	8	100	17	1	...	...	...	...	118	...	118	...	...
,,	F_3	,,	21	540	74	...	...	...	...	...	614	220	834	3 : 1	>0·30
,,	F_3	Non-branched	7	...	...	...	...	...	...	...	...	248	248	...	...

THE INHERITANCE OF HEIGHT *CUM* DURATION IN SORGHUM*

BY G. N. RANGASWAMI AYYANGAR, B. A., I. A. S.,

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and

A. KUNHIKORAN NAMBIAR. B. Sc. Ag.,

Assistants, Millets Breeding Station, Coimbatore.

In cereals, height and duration are important economic factors. Their mode of inheritance has been the subject of extensive studies. These factors are of special interest in sorghum in view of its great importance from the fodder point of view and especially since it is a cereal of dry tracts.

In maize there are several forms of dwarfishness, all of which proved monogenic recessives to the normal type (Matsuura, 1933). In wheat many instances of height segregations have been recorded, in most of which the dwarf forms were recessive to the normal (Matsuura, 1933). Winge (1924) has recorded the occurrence of dwarf types, some of which segregated into dwarfs and normals in the ratio of 3: 1, while other dwarfs gave a 1 : 1 ratio. "The results were not satisfactorily explained." In barley both dominant and recessive types of dwarfs have been met with and described (Matsuura, 1933). Parnell *et al* (1922), Akemine (1925), and Nagai (1926) have described dwarf rice plants which behaved as recessive to normal. Sugimoto (1923) reported a dominant type of dwarf plant. Ramiah (1933) observed that shortness may be a simple dominant to tallness or *vice versa.* The behaviour of the F_1s and F_2s in complicated cases strictly conforms to a Mendelian interpretation on multiple factor hypothesis.

As regards the time for maturing many instances have been reported on wheat, oats, and rice. In most cases the late maturing quality is dominant and is governed by two or more genes. However, Tschermak (Matsuura, 1933) observed that in wheat earliness was dominant in F_1 and obtained a complex segregation in F_2. Similar results were also reported by Nilsson-Ehle (Matsuura, 1933). Florrel (1924) has recorded an instance of dominance of earliness in heading period in F_1 and an F_2 segregation approximating 3 : 1, indicating one allelomorphic pair of factors, with possibly a number of minor modifying factors. Clark (1924) also has reported a similar experience. Aamodt (1927) obtained an F_2 ratio of 15 : 1 for early and late heading types in a cross between a late heading Marquis-Kanred hybrid with Marquis wheat. In rice,

*Paper presented at the Agricultural Section of the 24th session of the Indian Science Congress, January 1937.

Hector (1922) obtained a clear monogenic ratio in F_2 of a cross between an early and a late veriety, earliness being recessive. Bhide (1926) also reported a similar experience. Ramiah (1933) observed that the inheritance of earliness in rice may be quite simple in some cases showing a single factor difference, and rather complicated in others, which could be explained only under the multiple factor hypothesis. As regards earliness and lateness, earliness is generally found to be dominant though a single case has been recorded where earliness was recessive.

Conner and Karper (1927) while pursuing hybrid vigour in sorghum studied inter-varietal and intra-varietal crosses between different height groups in feterita, kafir and milo. "The three inter-varietal crosses made were characterised by marked hybrid vigour both in F_1 and F_2, but the intra-varietal crosses showed no hybrid vigour. Crosses between Extra Dwarf milo and Standard milo gave the F_1 which was intermediate between the parental heights, and the F_2 distribution ranged from one extreme to the other. Extra Dwarf milo crossed with Dwarf milo showed increased height of plant in F_1. The difference between these two varieties was considered to be due to several genes, the increased height in the hybrid being probably an expression of two or more complementary genes for height. Crosses between Extra Dwarf feterita and Standard feterita displayed a monogenic difference between the parents, the tall variety dominating." (Matsuura, 1933). Later Karper (1932) obtained "tall" mutants in kafir as hybrids which gave simple segregations for tall and normal in the F_2, tall being dominant. The increase in height was considered to be entirely due to the elongation of the internodes and not due to increase in the number of nodes. Sieglinger (1932) reports that in crosses between Standard broom-corn and Western Dwarf or Whisk Dwarf, the F_1 was like the Standard parent, and the F_2 gave a simple monogenic segregation for Standard and Dwarf. But in a cross between the two Dwarf types, the F_1 was of the Standard type and the F_2 gave a di-hybrid segregation of 9 Standard to 3 Western Dwarf to 3 Whisk Dwarf to 1 Double Dwarf. Sieglinger (1933) obtained also a monohybrid segregation for normal and dwarf plants in the F_4 generation of a cross between Red kafir and Reed kafir. The dwarf type is considered as resulting from a mutation due to the loss of a single height factor from the normal. Except in height and head length, the normal and dwarf plants were very similar.

In this paper an experience in sorghum in which "short-early" plants proved simple dominants to "tall-late" plants is recorded (Rangaswami Ayyangar 1934 a, b). In the Kurnool area of the Madras Presidency, sorghum is sown in the month of September and harvested early in January. Varieties that are longer in duration than the local variety, *Patcha Jonna* (*Sorghum Durra* var. *mediocris*, Snowden), do

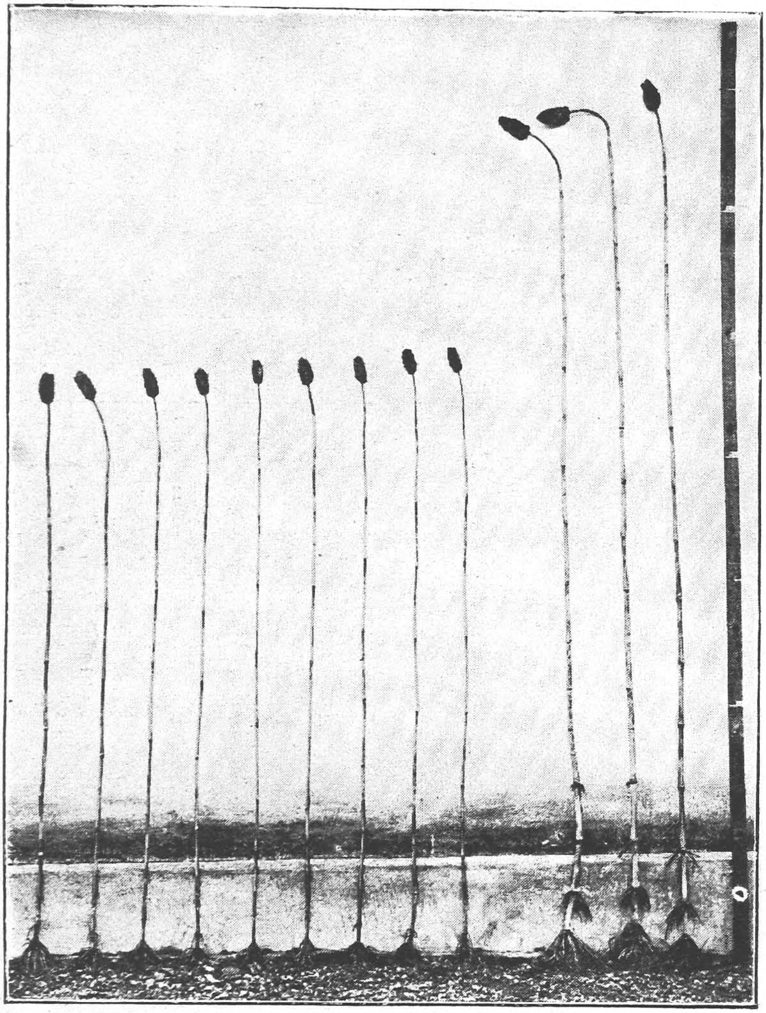


Fig 1. Segregation for Height *cum* Duration in Sorghum.

not fare well in that area. They remain leafy without heading. In a *Patcha jonna* selection (N. 29/15) grown at the Agricultural Research Station, Nandyal (Kurnool Dt.), in 1930, it was observed that out of a population of 130 plants, 95 were normal plants while 35 were rather tall, late, and un-headed at the time of harvest. Five ear-heads of the normal plants were taken over to Coimbatore and sown in August 1931. The subsequent behaviour of the progeny of these at Coimbatore is given in this paper. The August sowings at Coimbatore helped in bringing to maturity the "tall-late" plants that under Nandyal conditions could produce no earheads. This advantage of heading and seed setting was a great help in the pursuit of the character "tall-late."

By duration of a crop is generally meant the time for the crop to mature and be ready for harvest, from the time of its sowing. This duration can be divided into two parts: (1) the period of vegetative growth, and (2) the period of reproductive development. In dealing with duration, different writers adopt different indices, such as the first appearance of the earhead, complete emergence of the earhead, first opening of flowers, or complete maturity of the crop. In sorghum it was found that the duration, for comparative purposes, is best expressed in terms of the number of days from sowing to the flowering of the first spikelet on the earhead. This period can be recorded more accurately than other phases in the development of the plant, such as the appearance of the shoot, emergence of the earhead or ripening of grain. The height of plant was measured from ground level to the top of the earhead at maturity, rounded to the nearest multiple of 5 cm. The components of this height were gone into by recording internodal measurements.

Of the five earheads that were sown at Coimbatore, three proved pure for short-early and the other two segregated for short-early and tall-late. (See illustration and Table I.)

Table I.

Segregations for height and duration—F_3.

Family No.	Parental Character.	Progeny behaviour: Short — Early 120—220 cm. 69—79 days	Progeny behaviour: Tall — Late 190—300 cm. 85—98 days.	Value of P.
A. S. 631	Short-Early	93	32	
„ 634	„	88	21	
	Total	181	53	>0·30

It being now possible to secure seed from both the groups and to measure the heights of the tall-late group after heading, at harvest time, selections were carried forward from both the groups of these two families with the full complement of data on height and duration.

The F_4 was raised in 1932 and consisted of the following 24 selections (16 short-early and 8 tall-late) taken from both the families, A. S. 631 and A. S. 634. Of the 16 short-early selections sown, 10 segregated and 6 bred pure, while all the 8 tall-late selections sown, bred pure. The behaviour of the 24 selections is presented below :—

Table II.

Behaviour of F_4 Progeny.

a. Pure for Short-Early—(6 families).

A. S.	3140	A. S.	3145
„	3141	„	3150
„	3142	„	3151

b. Pure for Tall-Late—(8 families).

A. S.	3146	A. S.	3160
„	3147	„	3161
„	3148	„	3162
„	3159	„	3163

c. Segregating for Short-Early and Tall-Late—(10 families).

Family numbers.	Short-Early.	Tall-Late.	Unheaded and Sickly.
A. S. 3143; 3144; 3149; 3152; 3153; 3154; 3155; 3156; 3157; 3158.	840	226	108

It will be seen from the above that the short-early plants were a simple dominant to the tall-late plants, Owing to the newness of the introduction into Coimbatore, the long duration and excessive height, there were proportionately more casualities in the tall group, which accounts for the paucity of talls that flowered and ripened their earheads and whose duration and height could be recorded.

In Table III the height ranges and mean heights of the 6 shorts and 8 talls that bred pure are given. It will be noticed that there is a slight overlap in their height ranges. This overlap never obscures their separation as, "lateness" always helps in the determination of the shorter end of the talls.

Table III.

F_4 Selections from A. S. 631 and A. S. 634.
Range of Height in pure families.

Family numbers.	Height range cm.	Mean cm.
Pure short		
A. S. 3140; 3141; 3142; 3145; 3150; 3151;	100—240	175·1±0·6
Pure tall		
A. S. 3146; 3147; 3148; 3159; 3160; 3161; 3162; 3163.	190—375	296 1±0·8

In Table IV the height ranges of the 10 segregating families are recorded. The segregation is clear and the zone of overlap is guarded against with the help of the "late" part of the "tall-late" group.

Table IV.

Range of Height in segregating families in F_4.

Family numbers.	Height range in cm.		Mean cm.	
	Short.	Tall.	Short.	Tall.
A. S. 3143; 3144; 3149; 3152; 3153; 3154; 3155; 3156; 3157; 3158;	120—280	200—335	180·5±0·1	264·5±1·4

In Table V the ranges in the durations of the above 24 selections, both pure and segregating are given. The break in the durations is marked.

Table V.

Selections from A. S. 631 and A. S. 634.

Range in Durations.

Family numbers.	Duration range Days.		Mean duration Days.	
	Early.	Late.	Early.	Late.
Pure early A. S. 3140; 3141; 3142; 3145; 3150; 3151.	57—80	—	66·9±0·1	—
Pure late A. S. 3146; 3147; 3148; 3159; 3160; 3161; 3162; 3163.	—	90--119	--	100·6±0·1
Segregating A. S. 3143; 3144; 3149; 3152; 3153; 3154; 3155; 3156; 3157; 3158.	55—83	86--114	68·0±0·1	97·9±0·3

The early plants flowered from about 57 to 80 days after sowing. The late plants flowered between 90 and 119 days. In height, the short-early ranged from 100-240 cm. and the tall-late, 190-375 cm. The segregation was sharp, the combination of earliness with shortness and lateness with tallness gave, in the pursuit of each of these characters individually, a check on the other character, so that the accuracy of dates of flowering and measurements of height ran no risks in correct recording.

A fifth generation was raised by carrying forward 15 selections from family No. A. S. 3143. Of these 7 were tall-late and all of them

bred true. Of the 8 short-early selections 6 of them segregated again and two of them bred true for short-early. The segregations are given below:—

Table VI.

Segregation for Height *cum* Duration in F_5.

Family numbers.	Short-Early.	Tall-Late.	Unheaded and Sickly.
A. S. 3319; 3321; 3323; 3324; 3325; 3326.	812	266	16
Calculated 3:1	808·5	269·5	

It will be noticed that with greater acclimatization the number of tall-late plants is tending to show an increase there being a comparative absence of sickly unheaded plants. This late type probably mutational in origin, did not have optimum conditions for a healthy existence under Nandyal conditions.

This close association of the character pairs 'short-early' and 'tall-late' led to the examination of the components constituting the more definite and closely pursuable characters, short and tall, with which duration is associated. It was noticed that the average number of internodes in the short-early was 10·6 (average of 3935 plants) and that in the tall-late, it was 16·7 (average of 2020 plants). The internodal number remained the same in both homozygous and heterozygous families.

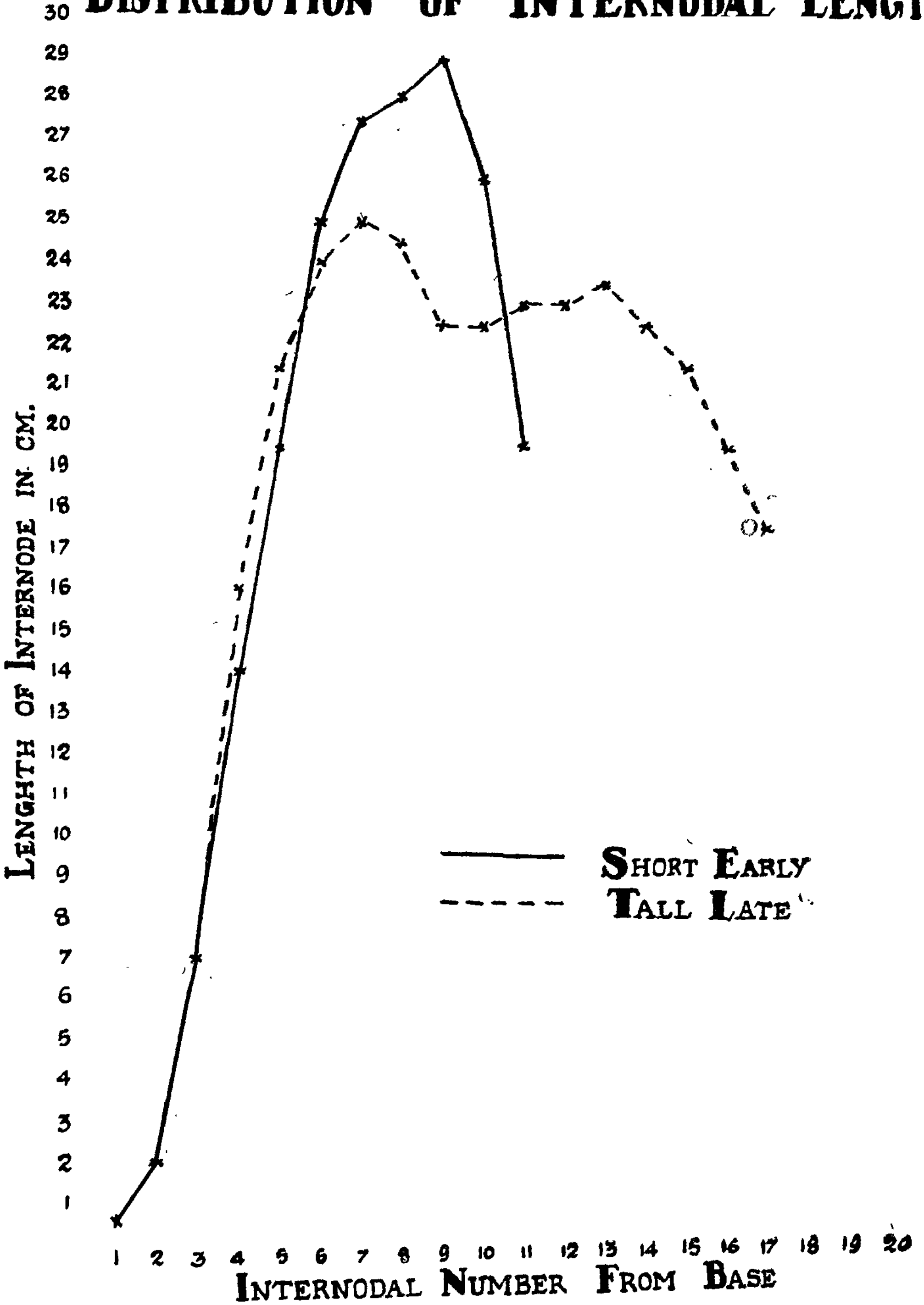
Table VII.

Number of internodes in the selections from a family segregating for height and duration.

Selection numbers.	Internodal range Short.	Internodal range Tall.
A. S. 3320; 3322.	7—13	—
A. S 3327; 3328; 3329; 3330; 3331; 3332; 3333.	—	12—22
A. S. 3319; 3321; 3323; 3324; 3325; 3326.	7—14	12--22

It will thus be noticed that tallness is the resultant of a definite increase in the *number* of internodes and not an increase in the length of each of the internodes. The length of individual internodes in each of the two groups was measured, and the trend of their lengths from the base upward is given in the following graph representing the average measurements on ten plants.

DISTRIBUTION OF INTERNODAL LENGTH.



It will be seen from the above that in the short-early group there is a steady increase in the internodal length with a drop towards the approach of the reproductive phase. In the tall-late group, in the early stages there is a steady rise, followed by a slight decline in the middle of its life and then again another increase till in the final pre-heading stages there is the usual decline. This bi-modal disposition in internodal length is characteristic of most long duration varieties of grain sorghum in which the early growth under favourable conditions, the middle period of comparative constancy and the later period of a pull up find a response and adjustment in internodal growth. The internodal studies at the Millets Breeding Station (now being written up) reveal a similar trend in the many varieties under study.

It will thus be noticed that in ultimate analysis the phenomena recorded in this paper are virtually a segregation for two types of internodal number, one of which (short-early type) has an average of 10·6 internodes and the other (tall-late) an average of 16·7 internodes. In the former the distribution in length is uni-modal whereas in the latter it is bi-modal. The uni-modal internodal disposition goes with earliness and the bi-modal, with lateness. A single factor difference seems to determine the segregation between the character composite short-early and tall-late, differentiated from each other both in the number and in the disposition of internodal length. This factor is designated $\mathbf{In_1}$. $\mathbf{In_1}$ $\mathbf{In_1}$ produces short-early plants with a uni-modal disposition of internodal length; $\mathbf{in_1}$ $\mathbf{in_1}$ gives rise to plants that are tall-late with a greater number of internodes and their bi-modal disposition on the plant. $\mathbf{In_1}$ is a simple dominant to $\mathbf{in_1}$.

It is interesting to record the fact that the primary requisite for normal flowering, free heading and good yield in the single stalked big-headed grain sorghums, is general vigour. This vigour finds an expression in an increase of height and a corresponding increase in the number of internodes. In both the "shorts" and in the "talls", within the range of height and internodal number characteristic of each of the groups, the quick and early flowering plants are generally those that are characterised by vigour as represented by increases in general height. (Rangaswami Ayyangar *et al*, 1935). The following Tables show this tendency graphically.

Table VIII.

Short-Early Type—A. S. 3346. The earlier plants are the taller.

Height in cm.	Duration in Days.														
	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77
175											1				
180															
185											1				
190															
195							2				1				
200										2			1	1	
205										1					1
210							1	1	2	3	1	2			
215							1		1	1				1	
220					1		6		1	4		1			1
225						3	4	1	2	1	1				
230						2	7	1	8	2	3	2			
235						1	2	3	4	3	3				
240						5	13	1	6	4	1				
245						2	6		12	3	3				
250				1		4	8	2	5	4	2				
255						3	7	1	3	1	2				
260				2		5	5		1	1					
265					2	6	3		7						
270		2		1	1	4	2	1	2	2					
275					5	5	1		1						
280		1			6	6	2		1						
285				2		2			1						
290		2			1	3	1								
295															
300		1			2	1									
305					1	2									
310				1	1		2		1						
315					1			1							
320					1		1								

Table IX.

Tall-Late Type—A. S. 3328. The earlier plants are the taller.

Height in cm.	Duration in Days.																																		
	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122
275																																1			
280																																			
285																			1																
290																																			
295																				1		1													
300															1						1														
305																															1				
310								1							1	1				1			1		1										
315					1												1												1				1		
320									1							1	1			3					1								1		1
325										1		2								2	1				2						1			1	
330					1																	1	2	1	1								1	1	
335											1		2	1	2				1						1										
340			1					1		1			1	2			1			1	1			1							1				
345				1	1			2	1	1		1		1	1					1			1	2	1							1			
350			1		2	1	1	1	1	1	2	1				1			1	1	1														
355				1	2	1			2	1		1		3			1			1											1				
360					3				3	4	2								1					1											
365	1			2	3	1	1	1	1	1	2	1	2			1		1																	
370			1	1	3		1		3								1																		
375				3	4	3				1		3									1														
380		1		2		2	2	1	1			1			1																				
385	1		2	3	3		1																												
390				3		1	1		3	1																									
395		1				1			1			1																							
400											1			1																					
405										1																									

It is interesting to note that the earlier plants are those that are taller and more vigorous and that the comparatively weaker ones lag behind in flowering. This fact explains why in this single stalked cereal a fine equipoise of favourable agronomic and environmental conditions from the time of sowing right up to harvest means a bumper crop and a disturbance in this optimum condition means famine. The grain sorghum is so big that if the main stalk gets a set back, the tillers never have a decent chance to pull up and replace the first head.

The impact between the definite tall-late with its pair short-early, giving a sharp segregation as between late and early, has not been without its effect on the composition of the short-early group. As has been experienced in such and similar quantitative characters, selections within the segregating groups, gave progenies which while being within the broad framework of the genetic group short-early, gave evidence of the existence of "shifts" (Engledow, 1923; Philiptschenko, 1927) the probable result of modifier genes. In Table X the behaviour of pure breeding short-early selections at various points in the height range is given.

Table X.

Pure Short-Early — Selections in the height range.

Selection No.	Character of Selection.		Progeny Behaviour			
			Height in cm.		Duration in Days.	
	Height cm.	Duration Days.	Range.	Mean.	Range.	Mean.
A. S. 3335	140	64	150—260	228 1±1·2	57—72	61·7±0·2
„ 3334	150	63	170—250	216·6±1·0	57—68	61·1±0·1
„ 3336	150	66	160—265	224·9±1·1	58—72	62 6±0·1
„ 3337	160	66	170—260	219 9±1·0	58—73	63 6±0·2
„ 3345	160	77	190—290	233·0±1·2	58—74	66·5±0·3
„ 3342	170	74	160—295	241·7±2·0	62—77	68·0±0·3
„ 3343	180	76	150—280	231·3±1·6	59—77	67·5±0·3
„ 3338	190	63	185—270	224·5±1·0	57—77	64·5±0·3
„ 3339	190	63	165—270	225·4±1·0	57—73	63·6±0·2
„ 3340	200	63	170—255	223 5±0 6	57—74	62·9±0·2
„ 3341	200	63	170—280	225·3±0 8	57—73	62·8±0·1
„ 3346	225	75	175—320	249 6±1·0	64—77	69·7±0·1
„ 3347	240	74	175—335	281 0±1·2	64—76	68·6±0·1
„ 3348	240	74	190—345	269·8±1·2	66—77	69·5±0·1
„ 3349	240	76	190—345	263·7±1·0	63—76	68·4±0·1

It will be seen that the progeny of selections taken at the taller end of the short group give a mean height in advance of the general height of the short group, thus enabling slightly taller early selections to be perpetuated. In the single stalked sorghum, as has been pointed already, a fine adjustment of environmental conditions is necessary for an optimum manifestation of height and vigour, and the pursuit of these fine "shifts" can obviously not be made in the tall-late group with its disadvantages in seed setting. The difficulties increase especially since in both the groups the earlier heading ones are more vigorous and give more normal plants whose height and duration

could be recorded without doubt, and whose seed is available for raising further progenies.

The effects of this segregation on the good earheads produced by the two genetic groups tall-late and short-early, were gone into. The average weight of earhead in the tall group was about 15 per cent more than in the short group. An analysis of a few earheads in each group showed, that in the tall group the average number of whorls was 10 as against 9 of the short group. The thickness of peduncle was 0·99 cm. in the tall plants and 0·78 in the short ones. The most noticeable difference was in the number of branches in each whorl. There was an average of 9 branches per whorl in the thicker peduncled tall plant as against the 6 of the comparatively thinner peduncled short plant.

In a number of families whose segregations have been recorded above, the midrib also was found to be segregating into white and dull-green signifying a segregation for juiciness of stalk, (Rangaswami Ayyangar, 1935 and Rangaswami Ayyangar *et al*, 1936). Cross collations between the factors $\mathbf{In_1}$ and **D** (Pithy stalks) in families segregating for both the factors are given below and prove the independent inheritance of the two characters.

Table XI.

Segregation for Juiciness of Stalk and Height cum Duration.

Family No.	Stalk — Midrib—	Short-early. Pithy White In_1D	Juicy Dull In_1D	Tall-late. Pithy White In_1D	Juicy Dull In_1D
A. S. 634 ...	...	69	19	15	6
3154 ...	...	69	15	18	5
Total ...	...	138	34	33	11
Calculated 9:3:3:1	...	121·5	40·5	40·5	13·5
		$x2 = 5{\cdot}137$, $P > 0{\cdot}1$.			

Summary. The inheritance of the character composite "short-early" and "tall-late" in sorghum has been pursued and set down to be due to differences in internodal number and disposition in length. In the short group there are about 10 internodes with a uni-modal distribution in length from the base upwards. In the tall group there are about 17 internodes showing a bi-modal disposition in length.

A factor $\mathbf{In_1}$ is responsible for the production of fewer internodes with a uni-modal distribution in length, $\mathbf{in_1}$ gives rise to a greater number of internodes and a bi-modal distribution of their lengths. $\mathbf{In_1}$ is a simple dominant to $\mathbf{in_1}$.

The "absorbing influence" of crossing is manifested in "shifts" that give in the short-early group, taller and slightly later plants, but conforming to the general grouping "short-early".

The earheads of the "tall-late" plants were heavier, had more whorls, and more number of branches in each whorl than the earheads of the "short-early" group.

Factor In_1 was independent of D the factor for pithy stalks.

Literature cited.

1. Aamodt, O. S. (1927) A study of growth habit and rust reaction in crosses between Marquis, Kota and Kanred Wheats. *Phytopath.* 17 : 573—609.
2. Akemine, M. (1925) On the inheritance of dwarf habits in rice (in Japanese) (Rep. Jap. Assoc. Adv. Sci.) 1:308—314. *(Abs. in Matsuura,* 1933.)
3. Bhide, R. K. (1926) Inheritance and correlation of certain characters in Rice crosses. *Poona Agri. Coll. Mag.* 18 : 76—85.
4. Clark, J. A. (1924) Segregation and correlated inheritance in crosses between Kota and Hard Federation wheats for rust and drought resistance. *J. Agri. Res.* 29 : 1—47.
5. Conner, A. B. and Karper, R. E. (1927) Hybrid vigour in Sorghum. *Texas Agri. Exp. Sta. Bull.* 359.
6. Engledow, F. L. (1923) The inheritance of glume length in a wheat cross. *J. Genet.* 13 : 79—100.
7. Florell, V. H. (1924) Studies on the inheritance of earliness in wheat. *J. Agri. Res* 29 : 333—347.
8. Hector, G. P. (1922) Ann. Rep. Dept. Agri. Bengal, India, 1921—22. (*Matsuura*, 1933).
9. Karper, R. E. (1932) A dominant mutation of frequent recurrence in sorghum. *Amer. Nat.* 66: 511—529,
10. Matsuura, H. (1933) A Bibliographical Monograph on Plant Genetics, 1900—1929. *Hokkaido Imp. Univ., Sapporo, Japan.*
11. Nagai, I. (1926) Studies on the mutations in *Oryza sātiva*, L II. On awned sterile, compact panicled and dwarf mutants. *Jap. J. Bot.* 3 : 55—66.
12. Parnell, F. R., Rangaswami Ayyangar, G. N., Ramiah, K. and Srinivasa Ayyangar, C. R. (1922) The Inheritance of Characters in Rice. *Mem. Dept. Agri. India, Bot. Ser.* 11 : 185—208.
13. Philiptschencko, J. (1927) (On the absorbing influence of crossing.) Bull. Bur. Genet. Leningrad, No. 5. Translation by *Imp. Bur. Plant Genet., England.*
14. Ramiah, K. (1933) Inheritance of Flowering duration in rice, (2) Inheritance of height of plants in rice, (3) Genetic association between flowering duration and plant height and their relationship to other characters in rice. *Ind. J. Agri. Sci.* 3 : 377—459.
15. Rangaswami Ayyangar, G. N. (1934 a) Recent work on the Genetics of Millets in India. *Madras Agri. J.* 22 : 5.
16. Rangaswami Ayyangar, G. N. (1934 b.) *Rep. Agric. Stations, Madras Presidency,* 1932—33. *P.* 373.
17. Rangaswami Ayyangar, G. N. (1935) Juiciness and Sweetness in Sorghum Stalks. *Madrās Agri. J.* 23 : 350—352.
18. Rangaswami Ayyangar, G. N. *et. al.* (1935) Relation of Some Plant Characters to Yield in Sorghum. *Indian J. Agri. Sci.* 5 : 75—100.
19. Rangaswami Ayyangar, G. N. *et. al.* (1936) Mendelian Segregation for Juiciness and sweetness in Sorghum Stalks. *Madras Agri. J.* 24 : 247—248.
20. Sieglinger, J. B. (1932) Inheritance of height in broom corn. *J. Agri. Res.* 44 : 13—20.
21. Sieglinger, J. B. (1933) A dwarf mutation in kafir. *J. Hered.* 24 : 337—338.
22. Singe, O. (1924) Zytologische untersuchungen uber speltoide und andere Mutanten—ahnliche Aberranten beim Weizen. Hereditas 5 : 241—286. (*Abs in Matsuura*, 1933.)
23. Sugimoto, S. (1923) Some examples of the production of anomalous races in rice. (In Japanese) Jap. J. Gen. 2 : 71—75. (*Abs. in Matsuura*, 1933).

SOME OBSERVATIONS ON SPHACELIA Spp. OCCURRING IN COIMBATORE

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Sphacelia represents the imperfect stage of the well known ergot fungus (*Claviceps spp.*). One species, *Claviceps purpurea*, invariably attacks rye grains and occasionally wheat and rye grasses (*Lolium* spp.) replacing the normal grain by a dark elongated sclerotium. This sclerotium is known as the ergot and though used in medicine is poisonous to both man and cattle. There are several species of Claviceps recorded on different grasses and *Juncus* spp. from Europe and America. The sphacelial stage has been observed on sorghum in several parts of India and Africa, on *Pennisetum typhoides* in Tanganyaka, on *Andropogon caricosus* var. *molicomus*, *A. annulatus*, *Pennisetum alopecuros* and *Ischaemum pilosum* in the Bombay Presidency. Ergot sclerotia were noted on *Pennisetum alopecuros* in India. The following are some of the observations made on Sphacelia affecting sorghum and *Panicum ramosum* in Coimbatore.

On sorghum the fungus causes what is commonly known as the 'sugary disease'. Ajrekar has recorded this from different parts of the Bombay Presidency, but the observations were confined to the black soil tracts. In Madras it has been observed in and around Coimbatore almost every year during the months of November and December, more of the disease being noticed in the latter month. It has been recorded from Koilpatti also but no attempt has been made to find out its distribution. The disease is more in the later sown crops.

The infection is said to be mostly in the flower stage and that when once the grains have passed the milk stage no further spread of the disease occurs. This is borne out by field observations also. The cold weather crop is often in the vulnerable stage during November or December depending on the time of sowing, the later the sowing the greater the disease. Even in early sown crops sometimes branches are produced which bear heads. These being later formed show more of the disease than the main heads. The disease is sometimes observed in January also when the crop is retained in the field and side branches bearing panicles are developed. The disease rarely occurs in the summer crop. Most of the varieties are affected. In all cases increased humidity and heavy rains favour the appearance and spread of the disease.

It is characterised by the formation of a big pearly turbid drop of sticky fluid, sweet to the taste and held between the outer glumes of the spikelets, here and there in the panicle. These fall on the leaves

and the soil causing a number of white spots on the ground all round the plant. The drops contain large numbers of conidia. The ovary alone appears to be infected and this is enveloped in a whitish mass of fungal hyphae which penetrate into the tissues also. When an infected panicle is dried, the diseased spikelets show a whitish oblong body between the glumes which on dissection is found to consist of a mass of hyphae and the surface is thrown into a number of ridges and furrows with closely packed conidiophores. The inner portion is of a honey coloured semisolid consistency. The dried up anthers and styles often project from the apex. In moist weather other fungi overgrow this whitish mass. No regular sclerotia as in *Claviceps* have been found in sorghum.

The conidia are hyaline, oblong or oval with rounded ends and produced in very large members, the drop of liquid formed in the spikelet being a highly concentrated suspension of spores. These germinate readily in water, the process starting in the course of four hours under laboratory conditions. By the next day secondary conidia are formed one from each conidium. The germ tube is given off from the extremities or the sides; and at its end an oval secondary conidium is produced. Ajrekar was not able to get secondary conidia but in Coimbatore these are formed readily. The spores were placed for germination in drops of water on slides. Those along the margin and those floating alone germinated; while others which were submerged did not germinate at all, probably due to lack of oxygen. Beyond the formation of secondary conidia further growth did not take place. The spores were plated in Richard's agar. The submerged spores did not germinate and no growth formation was noticeable. Spores were transferred to the sides of agar slants in test-tubes. In these the germination of the spores and formation of secondary conidia could be observed but further growth did not take place.

During November 1932 some plants of *Panicum ramosum* in the Millets Breeding Station showed a similar sugary disease. Here too whitish drops of a sticky sweet fluid were noticed protruding from several of the spikelets in the panicle and these contained numerous spores.

The drops dry up quickly when the panicles are cut and brought to the laboratory and form whitish crusts in and over the spikelets. The glumes are unaffected. The ovary is more or less replaced by a whitish mass projecting from between the fourth glume and its palea and a portion of this is spread over the other glumes also. The conidia are quite different in shape from those of the sorghum fungus. They are hyaline, falcate or sickle-shaped with more or less pointed ends, one-celled and measure $19{\cdot}8 \times 5{\cdot}8\mu$ the range being $14{\cdot}6 - 29{\cdot}2 \times 4{\cdot}4 - 7{\cdot}3\mu$.

They germinate readily in water and in 15 hours, long germ tubes with several short branches are formed. Such branches are not

noticed in the sorghum fungus. Secondary conidia are developed at the apices of the germ tubes in some cases, one on each germ tube. The behaviour of the fungus on solid media is similar to that of the fungus on sorghum.

The species of Sphacelia found on *Panicum ramosum* appears to be different from *Sphacelia Sorghi* McRae on sorghum. Ajrekar states that the spores of Sphacelia on *Ischaemum pilosum* were slightly curved, but in the absence of sketches and other details it is not possible to say whether the spores on *P. ramosum* resemble those recorded by Ajrekar. It was not possible to continue the observations on this host since its cultivation was given up at the Millets Breeding Station. So far as the author knows this is the first record of the fungus on this host.

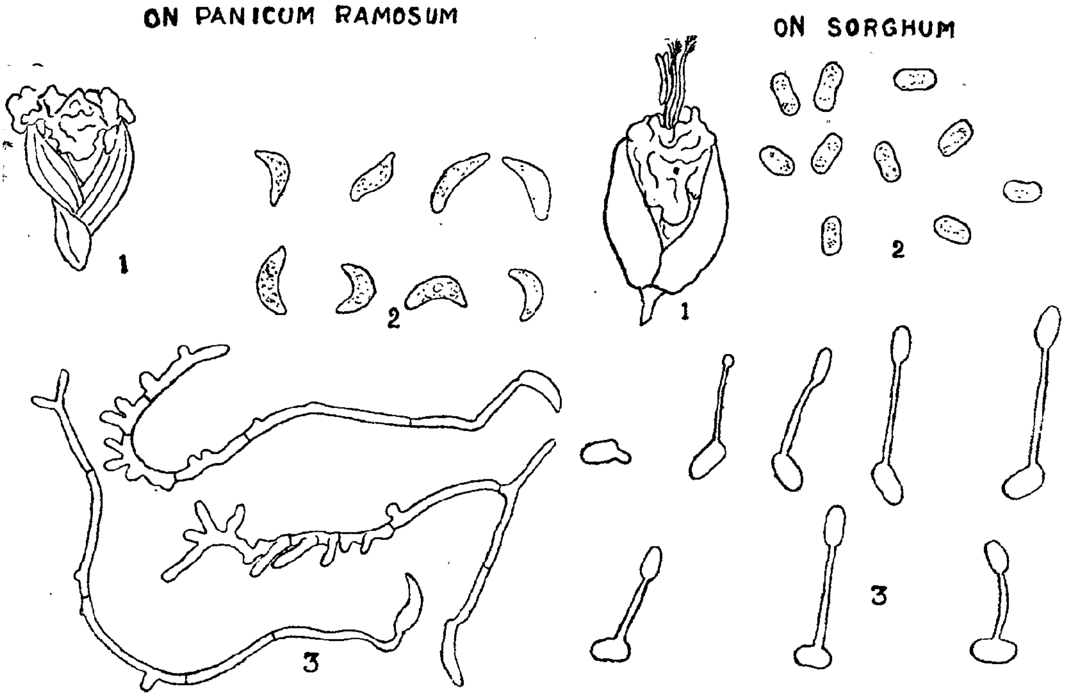
Reference.

Ajrekar, S. L. *Journal of the Indian Botanical Society*, 2, 55—61. 1926.

McRae, W. Notes on some South Indian Fungi. Year book of *Mad. Agri. Dept.* 108, 1917.

Ritchie, A. H. Entomological Report, 1925-26. *Abs. Rev. App. Myc.*, VI, 398.

Uppal, B. N. *et al.* Bull. 176, 1934. *Bombay Dept. Agri.*



Explanation of diagrams.

1. Diseased spikelet (dry).
2. Conidia (× 450).
3. Germinating conidia.

EXTRACT

The Indian Village—Its past, present and future. Extract of the address delivered by Rao Bahadur T. S. Venkataraman, B.A., I. A. S., F. N. I., *General President of the Twenty-fourth Indian Science Congress, 1937.*

No apology is needed in these days for talking about any aspect of 'village and village life'. The city and the town which were holding a complete thraldom over the public mind all these years are losing their glamour somewhat in spite of their admittedly alluring attractions, and the 'village' would appear to be getting increasing recognition, particularly in our country and in recent times.

India is situated in a comparatively densely populated area of the globe—about half the population of the world being crowded into a tenth of the earth's land region. This has had its effects on the type of agriculture practised in the country, the selection of crop for cultivation and the life of the people as a whole.

India also possesses a civilization and culture which was at least contemporaneous with, if not antecedent to, the civilization of Egypt, Mesopotamia, Greece, and Rome. After making considerable progress this civilization has, however, remained in a more or less quiescent and pertified state in our villages for well nigh two to three thousand years, little influenced by the great progress made by the West during the latter part of the same period. It is only within comparatively recent times that the Western civilization has come to spread into and influence, the country side.

The Aryan colonists on entering India found plenty of land to settle in, and the obvious advantages of group formation brought into being two main types of villages. One was the type similar to what is now termed 'ryotwari' where each family or group of persons took up as much land as they could cultivate depending on the number of cattle and able bodied men in the unit. Site for the village was chosen at some convenient spot such as the banks of a river or canal or proximity to other sources of water supply. The persons constituting the village chose a Headman who exercised all powers on behalf of the whole community. This type of village was generally associated with peaceful conditions.

The other type called 'Joint village' by Baden Powell, was founded by powerful families or class not necessarily agriculturalists. The government of such village was by the well known Panchayat system and occasionally a group of such villages belonged to the same clan or owed some kind of allegiance to the same warrior chieftain in return for the protection they enjoyed at his hands. In these villages the cultivating classes were sometimes in the position of tenants. 'Ryotwari' village sometimes got converted into 'Joint villages' through conquest by some warrior chieftain.

The village of South India would appear to have attained a high degree of perfection absolutely unaffected by Aryan influence from the North, so much so that certain authorities hold that some of the Aryan village institutions were copies of the Dravidian.

The headman was an important officer in village government. His office was hereditary and apparently a vestige of the ancient village chief. He was remunerated by grant of inalienable right to certain lands and later by being allowed to collect and utilize certain taxes from the villagers.

He was assisted by and later on effectively controlled by the village panchayat. This was a *council of elders not elected* and more or less self consituted from

the elders of the village who naturally and easily commanded the respect of the villagers. Justice was dispensed in the village temple and an oath before the local deity was potent in preventing persons from bearing false witness. The panchayatdars also knew the parties almost personally and were thus able to dispense quicker justice. The panchayat administered the village funds and thus commanded facilities for catering to village needs.

The village was practically autonomous and once the tax from the village as a whole was paid it had little to do with the central government and was not affected by change of dynasties. Taxes were levied for communal purposes as distinct from those by the emperor; and there was a common village fund which entertained the village guests, provided for the indigent and arranged for recreations, shows and performances of acrobatic and jugglery feats. The temple, the village tank, the guest house as well as other public utility concerns had a claim on this common fund. The central government helped in cases where works of common utility were beyond the capacities of the village. This help was given either by the waiving of certain Imperial taxes or by contributions in kind. The tax was sometimes levied in the form of manual labour and this is responsible for the huge and elaborate temples found in S. India. Occasionally also loans were raised by mortgaging the revenues of the village for definite periods.

There was not much sanitation in the modern sense of the word and no scavenging. Regular sweeping of the village streets was not common and the watchman who was responsible for sanitation thought his duty done when he pulled any carcass out of the streets. Diseases were naturally few on account of the healthier open life and there was no organised medical relief. The kitchen store contained most requisites for common ailments and the elders generally knew a few simple remedies from experience. The science of healing was, however, well advanced for the then conditions and comparatively cheap being based on easily available herbs and both metallic and organic compounds. The streets were broad. Each caste which persued its own profession lived in separate parts of the village and it was surrounded by a common and free grazing ground. The land during the Hindu period did not belong to the king but to the people who occupied it; hence, perhaps, the traditional and great attachment to landed property which still exists.

Fach village had a class of artisans who were hereditary and being non-cultivating were given definite shares of grains at harvest. In return for this the farmer was entitled to the services of the artisans both for his household and agricultural needs. Most villages had a school teacher who was maintained by voluntary presents from the parents of the children attending his school.

The village grew all the crops required to meet all its simple needs and the surplus of good ears was stored in the village granaries as a provision against future unfavourable seasons. Land was plenty, needs few and there was a great deal of contentment. The villager's outlook and knowledge were limited rarely extending beyond the confines of his own village. This had been the condition for well nigh two to three thousand years.

During this same period the West, on the other hand was rapidly evolving itself from a condition even more primitive than that of the Indian village to that of modern times. Various inventions and discoveries had enabled man to gain partial mastery over his environment and both time and space had been largely conquered.

Life has now become more complicated in all directions. The code of conduct which formerly was regulated by the simple ten commandments, has now to be regulated by a whole army of learned lawyers and the ever growing volumes of law books One very important result of the contact with the West has been the

development of the export and import trades which have affected profoundly the kind of crops grown and both the occupation and mode of the life of the villager. It steadily dragged him out of his isolation and threw him into the world currents of commerce and industry. Economics of the village was upset. The more enterprising and intelligent of the villagers are attracted by the commercial life and tended to shift themselves to the nearest town or city temporarily in the beginning but often permanently in the end. It is no wonder that such great changes have brought in their train a variety of problems.

One out-standing feature connected with Indian agriculture of the present day is its great dependence on the monsoons. Any one who has had to do with crop growing will realise how erratic the monsoons are both in time and quantity of precipitation. The unevenness and uncertainty of results in spite of his best efforts in the matter of cultivation and selection of seed, caused by factors beyond his control—such as drought, floods, and cyclones—render the agricultural income of the villager unsteady and uncertain. Secondly the villager is so little in touch with world markets wherein the results of his labours are evaluated and sold, that a large portion of his profits is intercepted by the intermediate agencies that market his produce. This is why the increase in the export trade has had comparatively little effect on the prosperity of the village as such. Thirdly, land available for crop growing has not increased to the same extent as increase in population. True some new lands have been brought under the plough and yeilds from existing lands have increased somewhat, but such increase is much less than the increase in population. The prevailing sentiments, both social and religious, that directly encourage large numbers of children were definitely needed in the olden days of plenty of land and low population. These are obvious misfits at the present time when conditions are just the reverse. Fourthly possibility of large augmentation in acre production is severely handicapped by a variety of causes such as subdivision and fragmentation of holdings and the prevalence of rigid social customs and religious sentiments which cause the waste of such valuable manures as night soil and cattle dung and adversely affect the business aspect of agricultural production.

* * * * * The continuous subdivision of lands has been a long standing feature and in certain parts has reached a considerable degree of fineness. It has gone so far as to divide the waters of a well each sharer being entitled to so many hours of lifting water from it. The Indian is, however, so much attached to his land be it small, and unremunerative, that he continues to own it if not forced out by other circumstances. Its possesion is not always considered as a business proposition but as necessary for status. This leads to the evil of absentee-landlordism. This state of affairs rules out large scale operations by outside capitalists who have the resources for up-to-date agricultural methods generally beyond the reach of the average cultivator. Another disadvantage is that it precludes fencing of the property, a valuable aid in raising agricultural efficiency. It also leads to constant and unavoidable disputes resulting from these long and irregular boundaries.

Further India is unique in possessing an enormous amount of cattle without making profit from its slaughter. The old and the weak are allowed to deplete the fodder stock of the village with the result that the fitter and hence the more useful ones do not get their due share. Cattle maintenance is not looked upon as a business proposition and the sentiment towards them is too deep seated for a rapid change.

With regard to village labour it may be stated that at certain periods, a large force of labour is needed and there is no demand during other parts of the year. This is particularly the case where the bulk of the area in the village is under the same crop. In the absence of work and hence wages all the year round, the

labour migrates to other places with the result that at the time of peak demand there is labour scarcity.

The villager is being made increasingly aware of the changes around by the extension into the village of such symbols of modern life as the post and telegraph, the bicycle and the motor bus. Economically he finds himself in a very disadvantageous position owing to his steadily diminishing agricultural income in contrast with increasing expenditure due to changes in living even in his own household. Innovations in dress and habits and new wants like tea and coffee are steadily forcing up family expenses. While the community life of interdependance has ceased to exist, the medieval social structure like the joint family system still persists rendering the villager's life unbalanced. Extra profits from an exceptionally good year are more often wasted in urbanizing his surroundings than being put by as reserve against lean years. Expenses on marriages and funerals are other sudden items of expenditure. The margin of extra income is so narrow that the loss of a buffalo or the long illness of the working member in the family is known to drop the villager down in the social scale sometimes never to recover to his original position. The only security he can offer against such debts is the land, his only possession in this world, and once pledged he finds it difficult to redeem it.

It may be remarked here that one common complaint laid at the door of the Indian by others and of the villager by the towns-men is what is termed 'low standard of life'. There exists, however, considerable confusion as to what the term really means and though it is but vaguely understood, it is nevertheless readily resorted to, when there is no room for sound and logical reasoning. To put it briefly and in easy language a higher standard of life may be defined to consist in getting more out of life's opportunities to the advantage of both the individual and his society. A rise in the standard of living must add to the productive efficiency of the individual or it is no HIGHER though it may be a DIFFERENT standard. All real progress and civilization are interpretable only on this basis. But when a townsman, weak in physique through wrong and unsanitary living, with a diversity of unnecessary and unhealthy wants and unnecessarily and perhaps also harmfully dressed, talks of his higher standard it is an obvious misapplication of the term. It is a case of a more EXPENSIVE and not HIGHER standard of life. A healthy cultured villager with his fewer and simpler needs but greater depth of character is easily the superior.

The merchant, with his desire, for commerce has a tendency to synonymise 'higher standard' with 'increased wants and greater purchasing power'. While an increase in wants as the result of a fuller life—such as books, works of art or facilities for quicker locomotion—does represent a higher standard, it ceases to be such when the increased wants are unnecessary, wasteful or harmful to the individual or society.

The most serious of the unfavourable changes coming over our village is the steadily increasing exodus of people from the village to the town. One main reason for exodus is the growing inadequacy of agricultural income not supplemented by income from other sources. A second reason is the shifting of main activities of life to the town. Educational facilities and other urban conveniences are increasingly attracting the villagers to the town. When the person has lived in the town for sometime, he often develops a dislike for village life with its limited comforts

The rapid increase of population in our country and China has become a byword and this renders incumbent a further increase of agricultural production. Science has so far not succeeded in growing crops on the roofs of houses or on road sides in towns and the best achievements of agriculture have been in the

country side. The clearly indicated line of advance for the future, therefore, lies in improving rural conditions and rendering our villages better and more efficient in the discharge of duties set to them by the country as whole, viz. (1) the proper and adequate feeding of the steadily increasing population, and (2) rearing a healthy stock of men and cattle and maintaining them in a fit condition. Both town and village are needed for the full and complete development of our country as a whole. But each has certain specific advantages and inevitable defects. In crop growing, when one comes across two types both of which possess desirable characters, the crop servant—called the breeder—tries to raise hybrids between them for producing kinds which might combine in themselves the good points of both and eliminating as far as possible the defects of either. A similar procedure is indicated between the town and the village and such a process is already in progress and it is desirable to speed it by conscious endeavour. * * * *

As the efficiency of any programme of rural improvement depends primarily on the chief agent in it, the villager, it is important to consider means for increasing his efficiency. If we compare the villager with the townsman, one point in which the latter often scores over the villager is his literacy if not always his education. Though it is true that the village teacher did exist in the olden days and atleast certain classes of the population received some kind of school and even higher education and though there is evidence that reputed universities did occasionally flourish in certain rural parts, regular schooling and education were not considered essential. Education given in the village school should obviously possess the rural and agricultural outlook and be vitally linked with the every day life of the village. Nature study lessons fit in well with the agricultural life of the villager and I have often wondered why the village vacations should be timed to the conveniences of metropolitan examinations rather than to the busiest agricultural seasons in the village when the boys could perhaps help their parents in the field and gain first hand knowledge of subjects taught in the school room. A second characteristic of the villager as contrasted with the townsman is often the slower moving intellect of the former. The linking up of villages with towns and other villages through better communication facilities, will remedy the situation. Yet another common defect of the villager is the lack of so called 'business' habits and 'business' mentality. This again is due to his environment and tradition. Nature's processes with which the village agriculturalist is primarily concerned do not generally need the punctuality of the man of business or commerce. The absence of insurance measures in our villages as in Denmark and Switzerland against crop failures and cattle epedemics, which are by no means uncommon, is largely attributable to the absence of education and business outlook. The villager's income would be both enhanced and rendered steadier by the import of the 'business' mentality into his activities such as agriculture and cattle maintenance. The villager's outlook on the world is often narrow because of the isolation and the absence of literacy. Whether he likes or not, the villager is being dragged into the world currents of commerce and industry and his horizon needs to be broadened by education.

In this study of the Indian village, the villager and village life, we have frequently noticed the need and advantages of industrializing the village. We have found that industries are desirable in the village to find employment for the people all through the year, to stabilize labour, to tone up the villager in various directions and to supplement and steady his income. The large scale industries, which have developed in the country have helped the villager but little. On the other hand, they have adversely affected the village tending to draw labour and brains away from the village. What is needed is the establishment

of cottage industries in the village itself so as to improve the conditions for living in it.

It is obvious that the closer such industries are linked up with agriculture and agricultural products the better they would fit in with village economics. Cattle being an important adjunct of agriculture, industries like cattle breeding and production of milk and milk products at once suggest themselves. Bee keeping, poultry breeding, fruit growing and canning and preparation of tinned and infant foods for the benefit of the townsman would fit in well into the village. Other suitable industries would be the partial preparation of manufactured products in the village itself as a rural industry. Cotton ginneries, seed decorticators and oil presses belong to this group. Minor industries connected with products or articles available in the village or vicinity, such as coconut industry on the West Coast and fish curing in seashore villages, help to keep the villages prosperous. Other handicrafts and domestic industries, where the needed material is imported from outside and worked in the village during the off-seasons, include weaving, dyeing and the manufacture of toys and trinkets. The mechanical efficiency obtained in the village as the result of such rural industries gives the village a 'maistry' class who should prove increasingly useful in the repairs and upkeep of farm machinery and water lifting pumps which are spreading in the country.

The purchase and sale of articles connected with cottage industries, need grouping together through co-operative organizations for best results.

As a class our villages lack the conveniences and amenities of urban life, convenience like means for rapid transport, the post and telegraph, the newspaper and the ever increasing improvements associated with the development of electricity are major blessings which it is desirable should be extended to the villages as quickly and as completely as possible. It is the absence of these in our couutry side that it is partly responsible for the prevailing distaste to village life. The village is easily healthier than the town in such important factors as pure air and open spaces and if only certain urban facilities are implanted in the village, its attractions for settlement should prove irresistible.

The general tendency for retired government officials not to return to the village but settle in a nearby town has struck me as unfortunate and is indicative of the general trend. While in certain cases perhaps the decision might be due to urban educational facilities, there is little doubt that the general unattractiveness of village life also enters into the decision. For permanent results the urge for rural improvement should be implanted in the village itself. This could be achieved only by improving the chief natural agent in such work--viz. the villager—and making it attractive for him to live and have his being in the village itself.

To sum up, there is little doubt that the villages of old were more populated than they are today largely because of conditions prevalent at the time. Those conditions will never return however much or sincerely we may banker after them. The town and the characteristics associated with urban life are definite products in the march of events and need to be accepted as such. Though there are drawbacks associated with urban life the town has its own good points which need extension into the village to keep rural life in tune with the changes around us. At the same time the countryside has advantages like open spaces and absence of congestion which can never be reproduced in the town.

Life activities that were village centres in the past are increasingly getting town centred to the disadvantage of the former. In the interest of the country as a whole, relationship of mutual help need to be estabished between the two. The town should extend to the village its greater knowledge, quicker living and

manifold amenities of the modern age. Contributions from the countryside are of equal importance. It alone can produce the raw materials of commerce and industry and thus help in the growth of towns and cities. It alone can supply adequate and wholesome food to the millions of our land whether resident in the village or town. Lastly, the countryside alone can imbue the urban 'business' civilization with the deeper character and larger humanities which are nurtured in the villager through his more direct and constant contact with the great forces of Nature and of life. Our duty then is clear: namely, to improve the *Village*, the nucleus of our country life and infect its Chief Agent, the *Villager*, with a chosen culture of the virus of modern age through *Education* and *Industrialization*.

Agricultural Jottings

BY THE DEPARTMENT OF AGRICULTURE, MADRAS

A Superior Groundnut Variety. Improved crops mean more money for the ryots.

The Government Agricultural Research Station at Tindivanam, South Arcot District, is almost entirely devoted to the improvement of oil seed crops, on which intensive breeding and selection work has been carried on during the last six years.

The most important among the oil seed crops of the Madras Presidency is the groundnut with an annual acreage of about two and a half millions or roughly about 50% of the area in the whole of India, and the produce of Madras alone is worth about 150 million rupees. With a view to obtain the most profitable varieties for South India nearly a hundred varieties from the various groundnut growing regions of the world have been carefully tested at the Agricultural Research Station, Tindivanam during the last six years.

Saloum or A. H. 25, a selection from one of the African varieties, has proved to be superior to all the other spreading or the runner varieties, under South Indian conditions. The duration is nearly 135 days; the increase in yield over the local variety commonly grown has been as high as 20% to 30% in parts of Nellore, Guntur, North Arcot, South Arcot, Salem, Trichinopoly and Madura Districts. Besides being a high yielder, the variety is superior to others in that it is more drought resistant and is, therefore, well suited to be grown under rainfed conditions, particularly in areas of low rainfall. The smooth and cylindrical nature of the pods facilitates easy harvest of plants with most of the pods in tact. It has another desirable quality, namely bold kernels, which is valued in the market. This new variety is not intended for the irrigated season for which the local variety is preferable.

Though the variety was first made available to the ryots only three years ago, it has found favour with the groundnut growers of the Presidency and the demand for the supply of seed has considerably increased. The reason why the area under the improved variety is not more than what it is at present, is due to the fact that sufficient supply of seed is not available, on account of low multiplication of seed: unlike small grained crops, in groundnut, the yield is only about twelve times as much as the seed rate. As it is not possible to supply all the seed that is in demand for sowing, groundnut growers who have been raising the improved variety will do well to utilise all the produce entirely for sowing purposes.

It may be added that the correct seed rate for the rainfed crop on red soils is about 60 lb. of kernels per acre.

Maize as fodder. It is well known that cattle would relish some sort of green fodder at any time during the year particularly so in summer. Every good farmer is, therefore, bound to provide his working animals with at least small quantities of succulent food. The material chosen must be capable of being grown throughout the year and give a good return within the shortest period possible. Maize satisfies these conditions. Trials made at the Agricultural Research Station, Koilpatti showed that it is ready for harvest within 45 days and yields over 30,000 lbs. of green stuff per acre. This quantity can be obtained from periamanjal cholam but it takes double the time as it cannot be cut before it is in flower.

Maize is best grown on red soils where facilities for irrigation exist. When sown at the outbreak of the north east monsoon rains a very good crop can be raised without irrigation. At Koilpatti, the crop was sown over an area of 50 cents at the end of September with the help of a rain and it was ready for harvest on the 40th day. The cost of cultivation was Rs. 18 and the value of the produce was Rs. 50 giving a net return of Rs. 32 on 50 cents. The green fodder was valued at 300 lbs. per rupee.

Any farmer having lands in the vicinity of a town can easily make this a business concern. He can readily sell his fodder in small bundles and also make money in selling green cobs. A small area can be left for seed purposes so that he can have his own seed next year. The experience at Koilpatti proves beyond doubt that the possibilities as indicated above are great.

Poudrette as a manure for Paddy, Flowers and Fruits. For a little over a decade, as a means of sanitary disposal, the Calicut Municipality has been collecting its night soil and transporting it to the trenching ground at Chervannur and covering it with earth. The site is a thinly populated suburb of the town and outside the Municipality. The daily output is 30 tons, lorries of 2½ tons load making 12 trips in all; this would manure annually a little over 2,000 acres of paddy. The locality has a vast paddy area, deficient in natural as well as added fertility, and 65% of it is single crop land where cultivation is carried on in the most perfunctory manner. All that is done by way of manuring is to sprinkle a little factory ash at sowing time.

Realising the high crop production value of human waste and the scope for work in this direction in the vicinity of the trenching ground, the Agricultural Department set to itself the task of utilising night soil as a manure which in the course of about a year was found absolutely free from noxious odour and fit for handling just as other manures. Trial plots were started 3 years ago. As local coolies refused to handle the manure more due to prejudice than ignorance, scavengers from Calicut had to be taken who were paid at 12 annas a cart-load for carting and spreading. It was a surprise to the ryots to see the Agricultural Demonstrator supervise the work at the trenching ground and in the field. Ryots were loud in their objections; some of them were that the manure was responsible for rank weed growth, for more straw than grain and for bad flavour and low keeping quality of cooked rice. With great difficulty and persuasion the first trial was conducted in 1934 and the result, though to a small extent vitiated by want of timely rains, was in favour of poudrette plots that gave a 10% higher yield in grain and 25% in straw than the controls.

In 1935-36 three trial plots were laid out sufficiently early and poudrette worked in the hot weather by constant ploughing to reduce the weeds. The difference in the subsequent crop was striking with an average net profit of Rs. 4 per acre over the control which convinced the ryot of the intrinsic merit of poudrette as a manure for paddy. For the second crop of the same year the

Department helped only with a half grant the other half being met by the ryots themselves. In spite of an indifferent season, a 20% heavier yield was obtained. This result has really impressed the ryots, and encouraged them to come forward early in 1936 for permission from the Municipality for 25 cartloads of poudrette which they carted and spread at their own expense. The ryot has thus been brought round to appreciate the advantage of poudrette as a manure and when price of paddy and financial depression improve it is likely that he would use it on a larger scale.

Similar trials were conducted in and around Mangalore with success. The Cattle Improvement Society, South Kanara, Mangalore, has used poudrette for manuring fodder grasses and the crop has responded very well to the treatment. Mr. K. T. Alwa, the well-known horticulturist of Mangalore, who carries away most of the prizes in the Fruit and Flower shows at Mangalore, writes as follows :—" I have been using this manure for the last four years with very good results both for my flower and fruit plants. I have tried all sorts of manures but there is nothing to beat this. Even for paddy, it is very good. Mr. K. Thimmappa Hegde has been using this extensively for his paddy cultivation." This valuable manure is still wasted in many places on account of the prejudice of the ryots to handle it; but the department is trying to overcome the prejudice by actual demonstration and it is only a matter of time for this organic waste to be utilised extensively for economic crop production.

Composting farm wastes. One of the factors for increasing the crop production is the manure supply. As the population increases, intensive cultivation has to be practised on the limited area available to meet the demand for the food products and the other necessities of agricultural produce. Cattle manure obtained from the cattle sheds is not enough to manure all the dry and garden lands adequately and the use of artificials alone is not desirable especially in dry lands. In all villages organic wastes are available. It is a common sight in South Arcot to see the cane trash in fields being set fire to, after the canes are harvested. Burning this waste produce is considered to be an economy as it saves the labour of removing the trash from the field. This is false economy. At Palur Agricultural Research Station cane trash is being converted into compost for the last few years.

The process consisted in putting small quantities of trash under the feet of cattle daily. The floor of the cattle-shed was at least one foot below ground with a hard bottom. Trash and other farm wastes were spread daily in the pit to serve as bedding for the cattle as well as to conserve the urine. The dung was spread evenly in the morning and another layer of farm waste was put over it. This was continued for about a fortnight. At the end of the period the stuff from the cattle shed was removed and heaped in a convenient waste land to make a long heap about ten feet in breadth and three feet in height. The heap was turned three times with an interval of about a month (preferably after heavy showers). The heap was moistened sufficiently to hasten decomposition. Cane trash treated in this way was ready for use in four months. Thus the manurial requirements of the dry lands can be amply met. The labour required for heaping, turning and moistening comes to Rs. 0—12—0 per ton of compost manure. This manure when analysed was found to contain a little more than half the quantity of nitrogen contained in the farm yard manure and compares very favourably with the cattle manure available in the villages.

As some organic bulky manures are necessary to maintain the physical condition of the soil the cane cultivators who do not require trash for any other purpose can convert it into compost and use it in their fields to supplement other manures and thus reap good crops at a small cost.

Selections of Seednuts and Seedlings in the Coconut. Good seed ensures good crops. In a crop like the coconut which may last as long as eighty years, and in which the bearing capacity can be properly judged only about twenty years after planting, the selection of proper seed is obviously of utmost importance. The mistake made in selection cannot be rectified later and the care and attention bestowed on gardens from poor seed would not be sufficiently recompensing.

There are two main types of coconut palms—the tall and the dwarf. The dwarf type, occasionally found in back-yards of houses, though a very early yielder, is not suited for economic planting on a large scale. It is only the tall type which is extensively cultivated for commercial purposes all over the Presidency.

Seednuts are best obtained from recognised seed centres with a reputation for quality. Nuts should be selected from high yielders, yielding about 100 nuts per tree per annum. Such trees can be recognised by a large number of leaves in the crown, by the lower leaves drooping down like the ribs of an opened umbrella and by their tall trunks. Trees with short and strong leaf-bases should be selected. Poor yielders, i. e. those yielding about 30 nuts per tree, per annum, as also irregular bearers are undesirable as seed material. Very young or very old trees are usually rejected for seed purposes.

The next consideration is the sort of nuts that should be selected. They should not be too big or too small—should be of medium size, round in shape with thin husk. Fully mature nuts harvested in the months of February to June are the best. Usually one or two nuts at the top and the bottom of the bunch are discarded. The nuts thus selected are dried in the sun for four or five days.

The selection should not stop with the nuts alone and should be continued in the nursery also. Intensive research on coconut seedlings carried on during the last several years at the Government Agricultural Research Stations on the West Coast, has shown that the following are the characters of good seedlings, i. e. seedlings which will grow into high yielders.

1. Early germination,
2. Large number of leaves in the seedling,
3. Height of seedling, and
4. Good girth of the stem of the seedling.

Such seedlings are mostly obtained from round medium-shaped nuts mentioned above.

It is always desirable to sow in the nursery about 40% more seed nuts than the number of seedlings required so as to have sufficient scope for selection, with a view to reject unhealthy and poor seedlings.

The Department of Agriculture is always ready to offer advice and possible help on this important subject of seed selection.

Time of application of Ammonium Sulphate for Paddy. Recent researches all over the world have brought out the value of artificial manures or 'fertilisers' as useful adjuncts to all bulky or organic manures. If the economics of the various systems of manuring are worked out, it is found that the application of a judicious mixture of artificials and organic manures yields the greatest margin of profit. Though the amount of fertiliser applied is very small, it gives a great fillip to the final yield, thus justifying the extra cost incurred. It must, however, be borne in mind that to obtain the best results, the optimum amount of fertiliser should be applied at the right stage of crop-growth.

In the case of the paddy crop, research work at the agricultural stations of the province has shown that a top dressing of ammonium sulphate over the usual

basal manuring of green leaf gives greatly increased yields. Though the usual agronomic practice in this province is to apply the manure at planting time, experiments conducted by the Agricultural Department show that the best results are obtained when the Sulphate is applied 4 to 8 weeks after transplanting, depending upon the variety of paddy, the nature of the tract and the fertility of the soil.

The experimental results show that significant yields are obtained when the manure is applied one month after planting at Pattambi (South Malabar), six weeks after planting at Coimbatore and two months after planting at Aduturai (Tanjore) and Maruteru (West Godavari). Developmental studies on the paddy plant have shown that this critical period when the manure has to be applied synchronises with the formation of the ear-head, which is approximately a month before flowering.

In general, for lands of average fertility receiving a basal dressing of green manure, an application of the usual dosage of ammonium sulphate, a month before flowering is highly beneficial. Its application at planting time can be of advantage in promoting initial tillering where fertility is low.

Sorghum for Popping. Sorghum, *cholam* (Tam.) or *jonna* (Tel.), is one of the staple food grains of the poor and backward classes in the presidency. One of the ways in which sorghum grain can be used as food or delicacy both by the poor and by the rich is by converting it into pops (பொரி Tam.) or puffed grains.

Among varieties of cholam grown in South India the group which is commonly known in the Tamil districts as *Talai virichan cholam* and in the Telugu districts as *Konda jonna* or *Muthyāla jonna* is the most suited for making pops. These sorghum varieties have grains which are small in size, with horny (not powdery) contents. These seeds have also thick seed coats. Sorghum varieties not having these characters do not pop well.

Popping is done by putting small quantities of grain on a hot pan kept over a steady fire. For popping large quantities, mud pots are generally used, while for small quantities small iron pans are found to be suitable. To get uniformly good pops, the grains should be only one layer thick at the bottom of the pan. To ensure the proper heating of all the grains they should be briskly stirred. A small brush made out of the midribs of the coconut leaf serves this purpose well.

As the grain gets heated by contact with the hot pan it swells and a longitudinal crack is developed on the bulging grain. This crack widens, and irregular cracks are formed cross-wise. The slight moisture in the grain is rapidly converted into steam by the heat applied. The thick seed coat offers resistance to the steam which tries to escape, with the result that there is an explosion and consequent evertion of the endosperm. The grain is thus converted into a chalky white puff which is usually hemispherical in shape with bits of the everted seed coat sticking to its bottom. A good pop looks like a tiny cauliflower in general appearance.

The popping of sorghum as a cottage industry exists in isolated places in this presidency. Pops are made into balls mixed with jaggery and are sold especially during fairs and festivals. They have a fine flavour and are easily digested. When the suitable type of grain is not available locally, the grain is imported from the Coimbatore and Cocanada areas of the presidency. There are reports of importations from Burma also.

In sorghum pops, the poor and the rich have a cheap and wholesome luxury and popping as a cottage industry deserves greater popularity.

ABSTRACTS

Soybean flour destroys Vitamin A. Flour made of legumes, particularly soybeans, and added to bread to improve the color of the crumb has been found to destroy its vitamin A content. The color which is removed by soybean flour is carotene, which is oxidized and hence decolorized in the process. Since carotene is the basic substance of vitamin A, its activity is thus destroyed. Similar tests with cod-liver oil have shown that soybean flour will destroy at least 99 per cent of its vitamin A content. (*Scientific American*, February 1937).

V. R.

Fertilizing from the Air. When wheat is grown in an atmosphere enriched with carbondioxide, Dr. Johnston reports, that the weight of straw, the number and weight of heads, and the number of grains increased in comparison with plants grown in ordinary air. The practical application of this type of fertilizer has not been found satisfactory in commercial work. (*Scientific American*, February 1937).

V. R.

Bedbugs alive for one year. An Entomologist kept bedbugs alive and fairly active for one year without any food whatsoever. This remarkable vitality explains the great prevalence of bedbugs. (*Scientific American*, February 1937).

V. R.

Artificial resin. With the increasing use of electricity for domestic and other every day purposes, there will be very few who are not acquainted with Bakelite and Bakelite products and many will be interested to know what Bakelite is and how it is obtained. An exceedingly good and readable lecture is reported in one of the recent issues of Royal Society of Arts. Though often called an artificial resin, it is only a product of the condensation of phenol and formaldehyde and is called a resin only because in appearance it resembles a resin. The condensation product when first formed is a solid which will melt on heating but solidifies again if the heating is continued for some time and in this last condition, it assumes the consistency and electrical properties of the Bakelite products commonly sold in the market. In manufacturing the various commercial articles, advantage was taken of this fact and nice looking and useful things are turned out quickly and in large numbers by simply pressing the semi-solid resinoid into appropriate models and heated till the resin sets to a hard mass irreversibly. It would be of interest to know that besides these phenolic resinoids, there are the Urea resinoids, Alkyd, Vinyl and Sterol resinoids. The reader is referred to the extremely lucid original article in the Journal of Royal Society of Arts for further information. (*Jour. Roy. Soc. Arts.* January 29th 1937).

Dr. S. K.

Review.

Text Book on Horticulture in Telugu by V. Venkateshwara Rao, Bhimavaram.

The book is primarily intended for the use of Secondary School students according to the requirements of the S. S. L. C. Syllabus and is, therefore necessarily elementary in its scope.

It deals with soils and their properties, hedges, implements used in horticulture, tillage, after-cultivation, manures and manuring, methods of propagation, insect pests and fungoid diseases and their control. A few notes on some of the most commonly cultivated flowering and orchard plants would however have made the book more complete.

There are few useful books on this important subject of horticulture easily available to the student and the teacher, and fewer still in the vernaculars. This book, it is expected, will, therefore, supply a long felt want and prove useful not only to the regular students studying for an examination and the elementary school teacher, but also to the amateurs in horticulture and serve as a brief introduction to the fascinating subject of horticulture.

The book, the first of its kind in Telugu, ought to be welcomed by all interested in the subject. The author derseves to be congratulated for his efforts which however humble they may be, should contribute much to the spread of knowledge in horticulture among the younger generation.

Copies can be had from the author for annas Twelve.

G. V. Narayana.

Correspondence.

Dear Sir,

In your issue of the M. A. J. for this month (March) I find an article on "*A new enemy of the honey bee*" by Messers M. C. Cherian and V. Mahadevan. In the introductory paragraph of the paper the authors while refering to a few previously known enemies of the honey bee have, I find, not made any reference to another wasp enemy of the honey bee recorded before from S. India with almost the same habits as *Palarus* and belonging to the same family *Sphegidae*. I would invite their attention to the following published papers containing information on it.

1. My paper on "Some insects recently noted as injurious in S. India". In which is recorded the bee hunter wasp *Philanthus Ramakrishnae T.* with a figure showing the wasp carrying a honey bee (published in report 3rd Entomological Meeting, Pusa, 1919).

2. "Bees and bee keeping in S. India" by myself and S. Ramachandran published in M. A. J., February 1934, P. 7 with a figure.

3. "Bee keeping in S. India" Madras bulletin No. 37 by S. Ramachandran with a forward by myself page 1, fig. 13, year 1935.

This sphegid wasp *P. Ramakrishnae T.* was discovered by me on the Bahabudan hills (4000′) in Mysore about twenty years ago; I also noted it later on the Nilgiris and on the Palnis. It was named after me by Mr. Turner of the British-museum as a new species.

'Girija' Farm,
Mundur, S. Malabar.
14—3—'37.

T. V. R. Ayyar.

Dear Sir,

In reply to Dr. T. V. Ramakrishna Ayyar's (Rao Saheb) letter I have to state that I am aware of the three publications, mentioned by him. These publications, especially Nos., 2 & 3 however do not contain much information on the wasp *Philanthus*. I am of opinion that this wasp is not of sufficient importance to be included amongst the insect enemies mentioned by me and Mr. Mahadevan in our paper on "A new enemy of the Indian Honey bee." Hence the omission.

It may be stated in this connection that the Mysore Entomologist also does not consider this wasp of an importance in his State.

Lawley Road P. O.
10—4—1937.

M. C. Cherian,
Govt. Entomologist.

Crop & Trade Reports.

Receipt of raw cotton at press and spinning mills.

Total cotton pressed and unpressed.

	Bales of 400 lbs. against an estimate of 533,100 bales for 1936–37.	Figures for corresponding period in the previous years.
1--2—37 to 19—2--37	9714	12394
Do. 26—2—37	13823	18618
Do. 5—3—37	19422	23661
Do. 12—3—37	26438	28497
Do. 19—3—37	33450	37400
Do. 26—3—37	43835	50938
Do. 2—4—37	59258	61937

	Cotton bales received at mills.	Exported by sea.	Imported by sea.
1—2—37 to 19—2—37	9662	6853	2712
Do. 26—2—37	13746	10634	2712
Do. 5—3—37	22018	15101	4025
Do. 12—3—37	29442	16227	4781
Do. 19—3—37	32967	19065	5980
Do. 26—3—37	38878	21187	24552
Do. 2—4—37	53275	24043	25186

College News & Notes.

Students' corner. The university examinations for the first and second year B. Sc. students commenced on the 5th instant, and for the third year students they will comence on the 14th.

Officers' club. During the Easter holidays open tournaments in Bridge (auction and contract) and Table Tennis were conducted. About 45 teams for auction bridge, 22 for contract bridge and 35 for Table Tennis competed. Players from Trichy, Gobichettipalayam, Avanashi, Tiruppur, and local clubs participated.

Auction Bridge:

Winners: Mr. Doraiswamy & „ Chandrasekhara Ayyar. } Annur.

Runners: „ Ponnambalam & „ Srinivasa Ayyar. } Coimbatore Cosmopolitan club.

Contract Bridge:

Winners: Mr. Vembathi Subramania Ayyar & „ Venkatasubba Ayyar. } Gobi.

Runners up: Mr. Somasundaram & „ Vetrivel Mudaliar. } Gobi.

Table Tennis:

Winner: Mr. Krishnaswami.

Runner up: Mr. N. Muthuswami.

The Tournament committee is to be congratulated on the unqualified success it had in the conduct of the above tournaments.

M. A. S. U. Please see the advertisement inside front cover page.

Weather Review (FEBRUARY 1937.)

Summary. Local thunderstorms have occurred during the middle of the month causing heavy showers on the north Madras coast and in the later part of the month in the hill stations. A few showers have also been recorded in the Ceded districts and south Madras. The rainfall has been appreciably above normal in the Circars, above normal in the Ceded districts, normal in the south, below normal elsewhere in the Peninsula. The chief amounts recorded are 5·3″ at Gopalpore on the 14th and 2·7″ at Vizagapatam on the 15th.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	7·8	+7·1	7·3
	Berhampore*	4·4	+3·3	4·4
	Calingapatam	3·2	+2·7	3·2
	Vizagapatam	3 1	+2·2	3·1
	Anakapalli*	2·9	+1·4	2 9
	Samalkota*	1·6	+0·8	1 6
	Maruteru*	0·9	0·0	0·9
	Masulipatam	2·8	+2·4	2·8
	Cocanada	1·0	+0·7	1·0
	Guntur*	0·5	-0·7	0·5
Ceded Dists.	Kurnool	1·0	+0·8	1·0
	Nandyal	1·1	+0·9	1·1
	Hagari*	0·5	+0·2	0·5
	Bellary	1·2	+1·0	1·2
	Anantapur	0·7	+0·4	0·7
	Rentachintala	1·6	...	1·6
	Cuddapah	0·3	+0·2	0·3
	Anantharajupet*	0·0	...	0·0
Carnatic	Nellore	0·7	+0·6	0·7
	Madras	0·0	-0·3	0·1
	Palur*	0·0	-0·5	1·5
	Tindivanam*	0·0	-0·8	0·4
	Cuddalore	0·3	-0·6	1·9
Central	Vellore	0·1	-0·2	0·3
	Salem	0·0	-0·3	0·0
	Coimbatore A. C. & R. I.*	0·1	-0·2	0·1
	Coimbatore	0·1	-0·2	0·1
	Trichinopoly	0·0	-0·5	0·3

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	0·0	-0·6	4·4
	Aduthurai*	0·2	-0·1	0·4
	Madura	0·0	-0·4	0·1
	Pamban	0·3	-0·4	4·2
	Koilpatti*	1·5	+0·7	2·1
	Palamkottah	1·1	+0·3	3·0
West Coast	Trivandrum	0·2	-0·4	1·4
	Cochin	0·9	+0·1	1·3
	Calicut	0·0	-0·2	0·0
	Pattambi*	0·1	-0·5	0 10
	Taliparamba*	0·0	-0·2	0 0
	Kasargode*	0·0	-0 6	0·0
	Nileshwar*	0·3	+0·1	0·3
	Mangalore	0·0	-0·1	0·0
Mysore and Coorg	Chitaldrug	0·0	...	0·0
	Bangalore	1·8	+1·7	1·9
	Mysore	0·7	+0·5	0·7
	Mercara	1·1	+0·9	1·1
Hills.	Kodaikanal	1·3	-0·1	2·2
	Coonoor*	6·4	...	7·5
	Ootacamund*	1 0	+0·2	1·3
	Nanjanad*	2·5	+1·9	2·6

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 (published in Fort St. George Gazette).

Weather Report for the Research Institute Observatory.

Report No. 2/37.

Absolute Maximum in shade	...	...	93·7°F.
Absolute Minimum in shade	...	...	62·5°F.
Mean Maximum in shade	...	...	91·2°F.
Departure from Normal	...	...	+0 6°F.
Mean Minimum in shade	...	...	68·2°F.
Departure from Normal	...	...	+2 7°F.

Total Rainfall	...	...	0·09″
Departure from Normal	...	...	0·21″
Heaviest fall in 24 hours	...	...	0·04″
Total number of rainy days	...	...	Nil.
Mean daily wind velocity	...	...	1·2 M. P. H.
Mean humidity at 8 hours	...	...	75 5%
Departure from Normal	...	...	+4·0

Summary. The mean minimum temperature was above normal by 2·7°F and the mean maximum by 0·6°F. Otherwise the general weather conditions continued to be normal.

Departmental Notifications.

I. Transfers & Postings.

Name of officers.	Transferred From	Transferred To
Mr. K. M. Jacob.	Taliparamba	Manantoddy.
„ P. Kesavunni Nambiar	Tiruppur	Palghat.
„ T. K. Thangavelu	Coimbatore	Coonoor.
„ M. Narasimham	Samalkota	Siruguppa.
„ S. Dharmaligam	Pattambi, A. R. S.	Coimbatore.
„ M. B. V. N. Rao.	Berhampore	Coimbatore.
„ K. B. Viswanathan	Berhampore	Anakapalli.
„ P. Somayajulu	Maruteru, A. R. S.	Maruteru, F. M.
„ P. Sitaramiah	Maruteru	Anakapalli.
„ V. S. Narayanaswami Iyer	Tanjore	Nannilam.
„ T. A. R. Iyengar	Nannilam	Arantangi.
„ V. A. Jagannadha Rao	Vizianagaram	Challpalle.
„ A. Doraiswami	Paddy Section	Co_2 Scheme Tiruppur.
„ B. G. N. Menon	Co_2 Scheme Tiruppur	Coimbatore.
„ R. Alagiamanavalan	Madanapalle	Kalahasti.
„ A. M. Muthayya Nattar	Aruppukottai	Pollachi.
„ L. Sankarakumara Pillai	Tinnevelly	Rasipuram.
„ D. S. Subrahmanya Ayyar	Rasipuram	Tinnevelly.
„ A. Chidambaram Pillai	Salem	Madura.

II. Leave.

Name of officers.	Period of leave.				
Mr. K. M. Venkatachalam Pillai	3½	months	on m. c.	from	18—1—37.
„ J. Suryanarayana	3	„	„	„	4—3—37.
„ K. Bramhachari	2	„	„	„	24—2—37.
„ K. Veerabhadra Rao	1	month	„	„	
„ Edwin Amirtharaj	2	months	„	„	
„ N Ramadoss	1	month		„	5—4—37.
„ R. Vasudeva Rao	2	months	on m. c.	„	12—2—37.
„ M. Subramaniam Pillai	3	„	„	„	1—3—37.
„ M. B. V. N. Rao	1	month		„	1—4—37.
„ B S. Narasimha Iyer	2	months		„	5—3—37.
„ A. Krishnaswami Iyer	6	„	on m. c.	„	26—1—37.
„ T. Gopalan Nayar	2	„	„	„	4—1—37.
„ I. Kurma Rao	6	weeks	„	„	4—3—37.
„ P. Parthasarathy	3	months	„	„	26—3—37.

PRESS COMMUNIQUE

Fort St. George, March 19, 1937

(G. O. Ms. No. 655, Development).

No 213—With a view to ascertaining the extent of unemployment among the educated classes in the Province, the Government directed the Commissioner of Labour and Rural Uplift to take a census of the educated unemployed, making a start with graduates in Law, Arts and Sciences and Diploma holders. The Commissioner issued a press notice in July last asking the unemployed among graduates in Law, Arts and Sciences and in Engineering and Medicine and Diploma holders in Economics and European languages to send in their names to him along with certain particulars. But only 759 persons responded to the notice. The Government consider the response most disappointing but propose to make another attempt but this time over a wider field so as to embrace all educated unemployed persons.

2. The expression "educated unemployed" requires as precise a definition as possible for the purpose of the census. The Government observe that the Sapru Committee of the United Provinces defined the expression "educated young men" as people who had received education at the universities, intermediate colleges, high schools, vernacular middle schools, or at the industrial or technical institutions or professional colleges or schools and passed one of the examinations specified in the margin. In regard to the question as to what was meant by "unemployment" the Committee held the view that young men who after taking a University Degree or Diploma remain without employment between the ages of 23 and 26 and in the case of men with only school education all those who have finished their school education but do not want to proceed to any university and remain unemployed should be treated as unemployed. These definitions do not, of course, claim to be perfect but seem to afford a basis to proceed upon and the Government direct that these criteria be applied for the purposes of the census of the educated unemployed of this province also.

M. A.
M. Sc.
LL. B.
B. A.
B. Com.
B. Sc.
B. Ag.
Intermediate in Arts, Science, Commerce and Agriculture.
High School Examination.
Vernacular Middle Examination.
Oriental Titles Examination.
Final Examinations of the Technical Institutions, Engineering, Medicine.

3. All the educated unemployed within the meaning of paragraph 2 above are accordingly invited to send their names within six weeks to the Commissioner of Labour and Rural Uplift, Chepauk, Madras, with the following particulars:—

(1) Name.

(2) Address.

(3) Qualifications.

(4) Employment, if any, previously held.

(5) Nature of employment sought.

Replies should be sent with the superscription on cover "Unemployment Enquiry".

C. J. PAUL,

Secretary to Government.

CONCESSION FORM

(For subscribers only)

To

The Secretary,

M. A. S. UNION,

Lawley Road P. O., Coimbatore.

Sir,

I am a subscriber to your journal and wish to avail of the 50% reduction in the Price of the Cumulative index from 1911 to 1930. Please send me by book-post a copy for which I am enclosing herewith postage stamps to the value of annas twelve, to cover both cost and postage.

Signature

Address

Madras Agricultural Journal

(ORGAN OF THE M. A. S. UNION)

Vol. XXV] MAY 1937 [No. 5.

Editorial.

Railway freight on dry cows from Madras. In the October issue of this Journal we, while commending the steps taken by the Indian Merchants' Chamber, Bombay for lowering the railway freight on cattle booked to and from Bombay, referred to a similar representation made by the Madras Provincial Marketing Board to the authorities concerned. We are glad to note that their efforts have met with considerable success. It was recently announced that from 1st February 1937, the freight rate per mile would be reduced from four to two annas per four wheeled vehicle carrying dry cows from Madras to all stations between Kavarapettai and Tenali, subject to a minimum charge and to a maximum in the number of animals carried in a wagon. Apart from this concession, the terminal charge of Rs. 4 now collected on each wagon of cattle imported into Madras, was abolished. We hope that these concessions will stimulate a greater movement of cattle from Madras to places where grazing is available in plenty and will eventually save the valuable Nellore breed from the hands of the butcher.

Payment of wages in kind. In an interesting and instructive press note issued recently on the survey of the wheat markets of India, it is stated that the " undoubtedly wasteful system of payments in kind * * * makes it difficult for the growers to benefit from an improvement in the price of wheat and it is suggested that early steps should be taken to abolish it and to substitute a money economy for a natural barter economy in the villages". We find ourselves unable to subscribe to this view. We are fully alive to the possibility that a change to the cash system will result in a greater quantity of agricultural produce now retained by the cultivators being brought into the market, and will make people realise quickly the position of the agricultural wages compared to that in other industries. It will also free the agricultural worker from the risks to which a farmer is exposed, improve his bargaining power, and enable him to spend his earnings on the purchase of articles of his own choice.

We should not at the same time lose sight of the conditions prevailing, and the forces operating, in the agricultural economy of this country. The survey of wheat marketing has brought to light more prominently than anything else, that the marketing conditions are always to the disadvantage of the grower, that "the number of people who consider themselves as entitled to take share of the cultivators' wheat was found to be astonishing" and that "the cultivator gets only about threefifth of the consumers' rupee". The additional obligation to pay his labour in cash would only tend in our opinion, to aggravate his difficulties. Under the present system of payments, there is available for the guidance of the grower, a sure and fixed scheme of expenditure which leaves him free to deal with the complexities of the market as best he can. This advantage would be lost to him if the system of cash payment is adopted. The Indian farmer is an utter stranger to the price-fixing factors that operate on distant markets and producer-countries, and to the caprices of the exchange. It is also an acknowledged fact that he is seldom able to command adequate and ready cash therewith to pay the labour engaged by him day to day. The result of the innovation under such circumstances is not difficult to foresee. A new class of moneyed exploiters will arise and the grower will not get even the threefifths of the rupee he now gets.

Nor is it a fact that the agricultural labourer in India is really in a position to take advantage of the proposed order of things. He is proverbially poor and has just the money or earnings to provide himself with bare food and clothing and has little left to trouble himself about the choice of his purchases. Situated as he is, the suggested change would only deprive him of the advantages, if any, of having with certainty all the grain he needs and place him at the mercy of an open market. Added to this there is sure to follow the loss of that psychological factor which contributes at present in no small measure to the harmony existing between the two classes. It cannot be gainsaid that this mutual relationship is more intimate and harmonious as a result of this system of paying wages in kind. The labourer feels that he is almost a member of the farmer's household when he partakes of the same produce that his master reaps. The loss of these features from the economic life of the village is certain to give rise to dissatisfaction and will result eventually in disputes and strikes which cultivators in general abhor.

We invite the attention of our readers to the *Press communique* published in this issue on the census of educated unemployed.

Tall Short

Plants of the Italian millet.

INHERITANCE OF HEIGHT OF PLANTS IN THE ITALIAN MILLET—*SETARIA ITALICA* (BEAUV.)

By

G. N. RANGASWAMI AYYANGAR, B. A., I. A. S.,

and

P. V. HARIHARAN, B. Sc. (Hons.)

Millets Breeding Station, Coimbatore.

Varieties of Italian millet vary very much in their height. An experience in the inheritance of plant height in this millet is recorded here. In 1933 a cross was made between two pure lines, S. I. 1646 and S. I. 2485 (vide illustration.) Both of these had a duration of 85 to 90 days. A first generation of 15 plants was raised. These were widely spaced with a view to selfing. Their average height was 119 cm. Contemporary to the F_1 the two parents were also raised. The average height of 200 plants of the tall parent was 111 cm. and of the short parent 75 cm. One of these fifteen F_1 plants, i. e., No. S. I. 2676 gave in the second generation 219 tall plants with an average height of 104 cm. (85 - 125 cm) and 67 short plants with an average height of 66 cm. (45—80 cm.) The segregation was sharp, there being no doubtful cases during the classification.

From this F_2, a third generation was raised. Of the six short plants that were taken all bred true to shortness. Their heights ranged from 45 to 71 cm. with an average of 63 cm. Of the twelve tall selections, 6 bred true to tallness, the height ranging from 99 to 114 cm. with an average of 106 cm. Six selections segregated again sharply and gave a total of 858 talls and 320 shorts ($x^2 = 2{\cdot}82$, P $> {\cdot}05$)

Along with the F_3, the parents were also raised. The tall parent had an average height of 110 cm. and the short parent 65 cm. It will be noticed that the parental and the F_3 homozygous height indices closely approximate. In the tall group, none approached the shorts.

It was thus clear that a single gene was at play in this segregation. The groups, tall and short, were analysed into their components. The number of internodes was counted in the main stalk in 275 plants in each group and was found to be an average of 11·49 in the talls and 10·10 in the shorts. The range in internodal number in both the groups was from 8 to 14. The slightly lesser number in the average of the short group is attributable to the compressed corm-like zone at the very base of the stalk. The cause for the differences in height was therefore not in the total number of the internodes.

The length of each of the internodes below the peduncle was recorded in 60 plants in each group and their averages are given in the following table (Table I).

Table I.

Average length of the internode on the main stalk of parents.
(Average of 60).

Number of the internode below the peduncle.	Length in cm. of the internode S. I. 1646 Tall.	S. I. 2485 Short.
Earhead	15·81±1·35	9·65±1·07
Peduncle	23·00±2·81	15·50±2·61
1st	7·45±0·93	6·60±1·58
2nd	8·10±1·29	7·27±1·82
3rd	7·70±1·31	7·35±1·75
4th	7·30±1·43	7·05±1·90
5th	7·20±0·95	5·65±1·31
6th	7·30±1·05	4·88±0·96
7th	7·19±1·09	4·45±0·83
8th	7·15±0·95	3·75±0·81
9th	6·13±0·83	2·40±0·65
10th	4·25±0·96	1·38±0·18
11th	2·37±0·71	
Total height	110·95	75·93

Table No. 1 shows that the tall group has internodes longer than the short group, proving that the gene at work is the one responsible for increase in internodal length[1].

A study of this table shows that there is a slight reduction in the length of the internode just below the peduncle, an experience recorded in some other cereals also[2]. A third point of interest is the fact that the total length of the peduncle and the earhead makes up a third of the total height of the plant. There is indicated a high relationship between plant height and head length. The average measurements for plant height and head length in the parents and in the homozygous F_3 are given in the following table. The relation of head length to plant height is obvious.

Table II.

Generation.	Population.	Mean height of plants. cm.	Mean length of earhead. cm.
Tall parent	200	110·94±·088	14·40±·085
F_3—Tall pure	750	106·46±·060	13·62±·090
Short parent	200	74·59±·082	8·51±·056
F_3—Short pure	819	62·87±·050	9·0)±·030

The earheads in both the groups, tall and short, were analysed and the results are presented in table III.

Table III.

Earhead Analyses of Parents.

	Average length of earhead.	Average thickness of earhead.	Average weight of earhead.	Average No. of Grains.	Average weight of Grains.
	cm.	mm.	gm.		gm.
S. I. 1646—Tall	18·8	16·2	7·6	2104	6·71
„ 2485—Short	10·1	12·8	3·5	1212	3·02
Difference between the averages of the parents.	8·7	3·4	4·1	892	3·69
't' value*	12·49	3·16	15·94	2·88	4·62

* 't' value for P = ·05 and n = 8 as per Fisher's table = 2·306

It will be noted that the earheads of the tall plants are longer, thicker, denser with a larger number of grains and with a heavier seed weight when compared with those of the short parent. The differences are statistically significant as measured by the 't' test.

Summary. In *Setaria italica*, tall plants with an average height of about 111 cm. proved a simple dominant to short plants with an average height of 75 cm. The segregation was monofactorial.

Both the parents had about the same number of internodes but differed in the lengths of the internodes. This internodal length which affected total plant height had its effect on the length, thickness and weight of the main earhead with corresponding increase in grain number and weight.

Literature cited.

1. Rangaswami Ayyangar, G. N., *et. al.* 1937. The Inheritance of Height—*cum*—Duration in Sorghum. *Madras Agric. J.* Vol. 25 No. 4. Pp. 107.
2. Rangaswami Ayyangar, G. N. and Hariharan, P. V. 1935. The Tillers of the Pearl Millet. *Madras Agric. J.* Vol. 23 No. 12. Pp. 474—477.

CULTIVATION OF CORIANDER (*Coriandrum sativum*) IN TINNEVELLY DISTRICT

Introduction. Coriander is one of the commonest condiments found in every Indian household as it is largely used for culinery purposes. It is also used in preparing confectionery. As it possesses medicinal properties, coriander decoction is the cheapest and the most commonly prescribed specific in every household for biliousness. Coriander is valued for the oil contained in the seeds.

Tinnevelly is one of the principal districts where coriander is largely grown. It occupies an important place in the system of cultivation in the black soil tracts of this district, and practically stands next to cotton as a money-crop. The income though small, proves handy to the ryot at a particular period of the year when no other money-crop is available to enable him to meet his sundry expenses

and to pay off the assessment on his land. Thus it plays a prominent role in the economic position of the black soil ryot and therefore, an attempt is made in this short note to describe the method of its cultivation as practised in this district.

Soil and rotation. Heavy black soils which generally crack deep in hot weather, are found to be well suited for growing coriander. In such soils, there is a regular practice of cultivating this crop in rotation with a crop of cumbu (*Pennisetum typhoides*) while in some places, it is also rotated with a crop of cotton (mixture of *Gossypium indicum* and *G. herbaceum*). But in light black soils, coriander is mostly grown as a subsidiary crop along with a main crop of cotton. In recent years, ryots in certain villages have also taken to a new method of mixed cropping of coriander and black gram (*Phaseolus mungo-L.*) in the same field.

Preliminary cultivation. The land intended for growing coriander, is ploughed with a country plough twice or thrice between April and August. The first ploughing is as a rule commenced in the month of Chittirai (April—May) as there is a popular belief built up by tradition and experience that a preliminary ploughing given to the land during this month, tends to give a high out-turn. Then in the month of Avani (August—September) an additional ploughing is done to a very shallow depth with the main object of catching early rains.

Manuring. Generally, no manure is applied to the coriander crop. The dryland ryot with a limited quantity of cattle manure at his disposal, manures his food-crop of cumbu in preference to any other crop. However, once in four or five years, some well-to-do ryots do manure coriander.

Sowing. When the north east monsoon sets in at about the month of Purattasi (September—October), seeds are sown broadcast and covered with a country plough. Generally coriander and Irungu cholam (*Sorghum dochna*,—Snowden) are the two crops to be sown first at the commencement of the monsoon. If rains are delayed, sowing is pushed through in the dry soil with a hope of getting rains late. But such dry sowings are rare and are not usually adopted. About 3 to 5 M. M. (Madras measure) of seed are sown in an acre while in a mixed cropping with cotton, the seed rate of coriander varies from ½ to 2 M. M. The seeds take 10 to 15 days to germinate depending upon the moisture present in the soil.

After-Cultivation. After sowing, no intercultivation is needed except hand-weeding. This is done once or twice and sometimes thrice if the land has not been given proper preliminary cultivation.

Harvesting and threshing. The crop begins to flower during the month of Karthigai (November—December) and becomes ready for harvest during the month of Thai (January—February). Plants are

pulled out usually in the mornings and taken to the threshing floor either on the same day or the next morning. They are allowed to dry for a day or two and then threshed. But, if the ryot has to attend to other agricultural operations at that time, he stacks the harvested plants in a dry state and threshes them later at his convenience. Threshing is done either by making cattle to tread on the plants or by beating with long sticks. The seeds are then cleaned by winnowing and finally stored after drying. It may be mentioned that cattle-threshing is favoured much as the final produce looks cleaner than that obtained by the other method. In some places ryots prefer to have their crop harvested and threshed on a system of contract in order to avoid personal supervision over labour employed.

Yield. The yield depends upon factors like type of soil, seasonal conditions, previous cropping in the field and incidence of insect pests and diseases. It varies from 2½ to 6 kottahs (240 to 576 M. M.) per acre in fields which had a crop of cumbu in the previous year and from 2 to 3 kottahs (192 to 288 M. M.) on fields where cotton was the preceding crop; in the case of mixed cropping with cotton, the out-turn of coriander is ½ to 1½ kottahs (48 to 144 M. M.) per acre.

Pests and diseases. Coriander is subject to a few diseases which in certain seasons, may assume very serious magnitude, causing great damage or even complete loss of the crop. During the flowering period, if it happens to rain and the mornings are misty, mildew sets in and flowers present a scorched up appearance and are shed. This disease is locally called 'Pumari' or flower-disease. If an ashy appearance is visible on any vegetative part of the plant, it goes by a local name of 'Samble-noi' or ash disease. By an attack of mildew the fruits also get discoloured with the result that the final produce fails to command a proper sale in the market. Further, this crop is susceptible to wilt disease, popularily called *Kanjura-noi* which causes sudden death of the plants. Again at the fruiting stage the fruits are bored by a caterpillar-pest locally known as *Kudavan* which eats away the contents leaving only the outer skin. These are the chief evils that may occasionally upset the fortunes of a coriander-grower before he enjoys the fruits of his labour.

Economics of growing coriander. It is to be particularly noted that ryots do not spend any amount in cash to meet the cultivation charges but pay in kind. However, the approximate cost of labour required per acre has been worked out under each item as shown below. Further, the item of manuring is not included as it is not a regular practice to manure the crop. It may also be noted that the value of the produce fluctuates very widely whereas the cultivation charges practically remain constant and hence the margin of profit is subject to a considerable fluctuation.

I. Cost of Cultivation

Details of operations	Kind of payment made as wages	Calculated Labour required per acre			Calculated cost per acre	Remarks
		Pairs of cattle	Men	Women	Rs. A. P.	
1. *Preliminary Cultivation.* a) Two summer ploughings.	Cumbu grain & food.	4	4	—	4—0—0	A man with a pair of cattle can plough half an acre a day. He is paid 3 M. M. of cumbu grain and one meal a day. A pair is charged at As 12 a day.
b) 3rd ploughing just before the break of the monsoon.	Do.	1	1	—	1—0—0	Very shallow ploughing.
2. *Sowing.* a) Broadcasting & covering with country plough.	Do.	1	1	—	1—4—0	Labour is costly at this time of the year.
b) Cost of 4 M. M. of coriander seeds used.	—	—	—	—	0—4—0	
3. *After cultivation.* Two weedings.	Cumbu grain only.	—	—	8	1—0—0	2 to 6 women per acre. About 1½ M. M. of cumbu grain per cooly per day.
4. *Harvesting.* a) Pulling out plants and carting to the threshing floor.	Do.	½	1	4	1—1—0	About 8 M. M. of cumbu grain for pulling out plants and ½ pair cattle for carting.
b) Threshing.	Do.	1	1½	—	1—1—0	A man is paid 2½ M. M. of cumbu grain per day.
5. Assessment on land.	—	—	—	—	1—8—0	
Total.		7½	8½	12	11—2—0	

II. Out-turn from an acre.

Value of 3 Kottahs of coriander at Rs. 5—12—0 per Kottah of 96 M. M.	Rs.	17—4—0
Less cultivation charges, as calculated above ...	„	11—2—0
Profit per acre ...	Rs.	6—2—0

Trade and market. Indian coriander is exported chiefly to the Straits Settlements and Ceylon. The Tinnevelly coriander is sent via Tuticorin port to Ceylon. At present, coriander is experiencing a great slump in the market due partly to the recent general economic depression all over the world and partly to the keen competition in foreign markets especially in Ceylon with Moroccan and Russian coriander.

THE ADAPTATION OF SHORT CROPPING OF SUGARCANE TO THE LOCAL CONDITIONS IN THE VIZAGAPATAM DIST.

Though attempts were being made during the past 5 years to popularise short cropping among the ryots of the Vizagapatam District, they have not yet adopted the system to any large extent, the area under short cropping even after five years' advocacy having been not more than 167 acres as shown below:—

1931—32	...	...	2 acres.
1932—33	...	...	27 „
1933—34	...	...	60 „
1934—35	...	...	90 „
1935—36	...	...	167 „

September-October was originally advocated as the time best suited for planting short crops as they can then follow a 'punasa' (early) crop of gante (*Pennesetum typhodeum*) or gingelly. But this was in practice, often found impossible owing to the lack of timely and favourable conditions for preparing the land and planting the crops in time. They were therefore recommended to be planted in ragi (*Eleusine coracana*) and gante seed beds after the removal of seedlings. In some years even this was found impracticable on account of heavy rains preventing the preparation of the land. Even in years when the land was ready, heavy rains at the time of or subsequent to, planting affected germination of the young crop so much that it had often to be abandoned. Earlier planting, in August, July or even in June was found more successful. In the case of arrowing varieties like Co. 213 planting has however to be deferred at least to the last week of June or early part of July to prevent the crop from arrowing in the usual season (November).

Though early planting was more successful and gave a higher tonnage of seed material it required the allotment of a separate plot for the whole year as in the case of the ordinary crop and this rendered short cropping less popular.

The intensive propaganda work done though not successful in enhancing the area under short crops to any considerable extent, has resulted however in convincing the ryots of the advantages of using tender material for seed. While, with late and nonarrowing varieties like J. 247 which are usually harvested at or shortly before, the time of planting, the use of tops (Vadu davva) or top halves has become popular, the same could not be practised with early and arrowing canes like Co. 213. In such cases, an alternative method was adopted by some ryots of the Bobbili taluk. This consists in leaving

out at the time of harvest in December—January all promising and tender side shoots not fit for milling and giving a ploughing and an irrigation if possible. This not only results in the rapid growth of the shoots thus left, but also stimulates a fresh flush of shoots some of which grow sufficiently well to give 3 or 4 setts by the time of planting (March—May). Even shoots which do not form sufficient nodes for being cut into setts but vigorous enough are found fit enough for planting. Sufficient shoots could thus be obtained for double or treble the area thus treated. Even under adverse conditions sufficient seed material to plant an equal area can easily be got. In areas where Co. 213 is largely grown this method has of late become rapidly popular, obviating the necessity for a separate short crop altogether, and the practice is well worth copying in other districts where similar conditions prevail.

PRACTICAL HINTS ON BEE-KEEPING*

BY M. C. CHERIAN & S. RAMACHANDRAN

I. **Introduction.** In these days of economic depression the income from agriculture is poor and the ryot, therefore, has to look to other sources to enhance his earnings. Taking into consideration the poverty of the average Indian ryot and his consequent inability to invest large sums on new ventures, bee-keeping on improved lines can be safely recommended as a paying cottage industry, as it involves only a small outlay. Moreover there is no dearth of bees or of bee-pasturage crops in this Presidency. Preliminary trials have shown that a colony of bees, under favourable conditions, is capable of yielding a net profit of about Rs. 10 to 15 per annum and as such there are great possibilities for this new industry.

II. **Selection of Bees for rearing.** Enormous profits are derived in the temperate regions by rearing the European bees, but their progress, apart from the prohibitive cost of importing them, has not been very encouraging in this country. Of the indigenous bees, the 'Rock' bee which is the biggest of the Indian honey bees and found mostly on the hilly regions, is unfit for domestication, because of its peculiar comb-building and migratory habits and ferocious temper. The 'Little' bee also has been found unfit for rearing, as it is migratory in habits and a poor honey gatherer. The Dammar bee, the smallest of the indigenous bees, is also not reared because of its poor honey gathering capacity. The only bee that can, with advantage be domesticated is the 'Indian bee'. It is smaller in size than the Rock bee and constructs its combs in parrallel rows inside natural hollows in tree trunks and in the ground, cracks and crevices in buildings, old pots etc. It is a fairly good honey gatherer and is comparatively mild in temper. The present paper therefore deals only with the Indian bee.

* This pamphet has been prepared for the Honey Week.

III. **Food of Bees.** Honey and pollen are the most important bee-foods. Both of these are available from flowers and the plants that provide these bee-foods are spoken of as bee-pasturage crops. The following are the important bee-pasturage crops observed round about Coimbatore:—Pollen yielders:—Maize, cholam, cumbu, castor, sunflower, peltophorum, zinniah, palmyrah, coconut, niger, cucurbitaceous plants. Nectar yielders:—Different varieties of cotton, tamarind, margosa, sunflower, plantains, niger, pungam, raintree, antigonon, white babool, drumstick tree etc.

IV. **The Bee Hive.** The artificial bee-hive is a miniature house designed to accommodate a bee-colony. There are various types of these hives, but in South India the most popular pattern is the Newton Hive. This consists of a brood-chamber and a super, with a floor board below and a top above. The brood chamber consists of a rectangular box open at the top and bottom and provided with a movable floor board below. It contains seven movable frames to support the combs. The super is a separate compartment meant for storing honey only and is kept over the brood-chamber when the latter is full of bees. The top is placed on the brood-chamber or the super as the case may be. Measurements of the various parts are given below:—

Floor-board	14″ by 9½″
Brood-chamber—inner measurements ...	9¾″ × 8¼″ × 6¾″.
Width of groove along the top of the front and rear planks of the brood-chmber to support the frames	¼″
Entrance to be cut along the lower side of the front plank of the brood-chamber ...	3½″ × ⅜″

Measurements of the brood frame:

Breadth of top bar	⅞″
Length of top bar	10″
Thickness of the top bar	⅛″
Inner length of frame	8¼″
Inner height of the frame	5¾″
Total height of frame	6″
Length of side bar	5¾″
Width of side bar at the top	1⅛″
Width of side bar at the bottom	½″

The top bar should be fixed exactly at the centre of the side bar so as to effect a clearance of exactly 1/8″ on either side. The length and breadth of the super are the same as those in the brood-chamber, but the height is only 3⅛″. Measurements of the super frames also are similar to those of the brood frames but the inner height is only 2½″.

The top is made to suit the hive body and a hole is provided in the front and rear planks and a big opening about 3" square in the ceiling plank to provide ventilation. Care should be taken to close all these openings with thin wire gauze.

V. **Hiving wild Colonies and Swarms.** After making a few hives the amateur should think of filling these with bees. This can be achieved either by capturing *wild colonies* or by *hiving swarms.* Wild colonies are generally found in enclosed spaces such as hollows in tree trunks, cracks and crevices in walls, old pots and the best way of locating them is by observing the likely places on bright mornings when numbers of bees will be seen going in and coming out of the burrows. Prior to the actual capture of the bees the entrance should be widened and the combs taken out gently one by one. Good-sized combs having plenty of brood should be selected and fixed to the frames with plantain fibre. The bees can then be induced to come to the hive by capturing the queen in a glass tube and placing it over the frames, after having closed its mouth with a piece of mosquito-net. In the absence of a tube, the queen can be caged in an empty match-box, care being taken to have it partially open. When the majority of the bees have entered the hive the queen can be liberated. In cases where the queen is not captured, clusters of bees that would, by this time, have collected inside the hollow can be scooped and transferred to the hive. The queen will, invariably, be found among these bees. Since the bees are likely to sting when being handled a few occasional whiffs of smoke from burnt rags may be necessary to quieten them.

VI. **Hiving Swarms.** Swarms are small groups of bees each with a queen, which issue from established colonies during the honey flow season and settle in some convenient place for a time in the shape of a bag-like cluster. Later on, these bees move away to some convenient place of abode and start a fresh colony. If one has a few colonies their number can easily be increased by hiving such swarms and keeping them separate. The capture can be effected by getting a new hive with the frames removed and placing in it a good brood-frame taken from one of the settled colonies. If the swarm is from the particular hive, from which the brood-comb has been taken, it can be given with the bees, if not, the bees have to be driven away. In either case, care should be taken to see that there are no queen cells in the comb. The hive should be held in such a way that a major portion of the cluster is inside the box. The bees, being attracted to the brood, quickly transfer themselves to the hive. The remaining frames and the top can now be put on and the hive kept at some distance away from the original colony.

VII. **After-care of Newly Captured Colonies and Swarms.** Wild colonies should, as far as possible, be hived only during the brisk breeding season, since the presence of the brood in the combs induces

the bees to settle in the artificial hive. Fresh captures should not be disturbed frequently, except for an occasional cleaning of the floor-board. Weak colonies should be fed with either dilute honey or thick sugar syrup. The frames should be examined after about a fortnight and the pieces of plantain fibre removed. Combs that have been improperly fixed and those that have dropped down must be refixed. The progress of the colony should be carefully watched and if egg-laying is not satisfactory, a brood-comb from another colony may be given. There is always the risk of the bees deserting the hive until they settle down to their normal routine of brisk pollen, honey collection and brood rearing. Such desertions can be prevented by the use of a queen arrester. This is a simple contrivance consisting of a piece of wood, longer than the entrance of the hive with a shallow cut about ⅛″ deep and just as long as the entrance. It is kept close to the entrance with the cut end below. The narrow slit is enough to allow the workers but not the queen and bees do not, as a rule, swarm out without their queen. The same precautions hold good for the newly hived swarms but a few additional old or foundation combs may be given to save the time and energy of the bees.

VIII. **Location of the Apiary.** An Apiary should be started only in a locality where there is plenty of bee-pasturage. Care should be taken to keep the hives absolutely level, in a place which is well protected from the hot sun, heavy rains and high winds.

IX. **Handling Bees.** Bee-hives should be opened and examined only on bright mornings when most of the bees are busy. Quick and nervous movements, incidental crushing of bees should be carefully avoided while handling the frames. The sting is fairly painful but the pain and the attendant swelling can be considerably minimised if the sting, which is left behind, is scraped away immediately. When the bees are in a bad mood they can be quietened by a judicious use of smoke.

X. **Swarming and its control.** Swarming in bees is the natural method of distribution and perpetuation of their kind. This instinct is very strong in bees and steps should be taken to check the impulse, since colonies get considerably weakend by the frequent issue of such swarms. This family separation occurs only during the prosperous season but the actual period may vary according to the locality. Prior to sending out swarms, the colonies multiply rapidly and the initial preparation for swarming is evinced by the excessive rearing of drones. This is followed by the erection of queen-cells along the lower border of the brood-combs and a series of swarms issue after these queen-cells are sealed. The most popular method of preventing the issue of swarms is the periodical cutting of the queen-cells. Another method which shows better promise is the destruction of the reigning queen or her removal with a comb of bees to a separate hive,

after the queen-cells in the original colony are sealed. The colony is kept under careful observation and all the other queen-cells are cut away after the new queen has emerged. The swarming impulse is lessened when the colony remains without a queen for a few days. Neither of the two methods mentioned above can claim to entirely cure the bees of their swarming fever. A third procedure may be adopted provided the conditions are favourable. If the swarming impulse is evinced early in the honey season, the first swarm may be allowed to issue and it may be hived and kept as a separate colony. The rest of the queen-cells should be removed after the emergence of the fresh queen. The owner in this case gets two colonies out of one and both of them may yield honey in the first year itself if pasturage conditions are favourable.

XI. **Care of colonies during the lean season.** Owing to adverse pasturage and weather conditions during certain seasons, the queen reduces her rate of egglaying and the population of the colony dwindles in strength. Under such circumstances, the bees may be fed artificially either with dilute honey or thick sugar syrup, by pouring a small quantity of the fluid over the frames once or twice a week. The feeding may be stopped as soon as a sufficient quantity of honey is found stocked in the combs.

Bee enemies such as the wax-moth, the black ant, the yellow banded wasp, and the death's head moth are very active during the slack season and necessary steps should be taken to check them. Of these the *wax-moth* is the worst enemy of bees. The caterpillars attack the combs and bees in the infested colonies very soon desert the hives. The following hints may be helpful in controlling this pest. All attempts should be made to keep the colony strong as such a condition enables them to withstand the ravages for a longer time. All superfluous combs are to be removed and stocked in an air-tight receptacle. A mud pot with its mouth sealed with cow-dung serves the purpose quite well. The combs should be frequently examined and those showing traces of damage should be promptly destroyed. The floor-board as well as the other parts of the hive should be kept clean. Pieces of discarded combs should not be thrown about carelessly. Necessary precautions should be taken to see that there are no cracks and crevices in the hive body. The interspaces between the brood-chamber, super and top should be examined for the egg-masses and if present should be scraped away. If there is a suspicion that the eggs have been laid in any of the inaccessible crevices, the hive body may be changed frequently. Combs that are stored for the next season's use are also likely to be attacked. The caterpillars infesting these combs can be easily eliminated, by exposing the latter to the morning sun, for about fifteen minutes, taking care to see that the temperature does not exceed 40° centigrade.

Another enemy that has to be guarded against is the *black ant.* These ants are particularly troublesome after the rains; sometimes causing wholesale damage to bee colonies by snatching away numbers of bees, very often grubs and pupae also. The pest can be easily controlled by dropping a few granules of calcium cyanide inside the ant holes. The hives can be kept on stands that have been provided with ant-pans. Occasionally bee colonies are visited by *the yellow banded wasp* and numbers of bees are snatched away. The wasps can be hand-netted and killed. Nests of these wasps can also be searched out and burnt during night time. *Death's head moths* occasionally enter bee-hives and steal away a good quantity of honey. Generally the bees themselves kill these moths after their entrance into the hive, but it is better to destroy them wherever they are found.

XII. **Care of colonies during the breeding season.** Since a strong population is essential for gathering plenty of honey, necessary facilities should be given for the rapid increase of bees during the breeding season. Old combs taken out and stored during the previous season may now be given at the centre and if these are not available, the combs at the sides, which are generally stocked with honey, may be transferred to the centre. This treatment apart from providing the necessary egg-laying space and stimulating the rate of egg-laying by the queen, also saves the time, energy and honey of the bees, which would otherwise be wasted in constructing fresh combs. Since weak colonies do not yield much honey, two or three of them may be united and built up as one strong colony. If this is not desired, the population of a weak and a strong colony can be equalised by inter-changing the position of the two hives on a bright morning when the bees are working briskly. The super may be added when the bee population has become strong enough to cover all the seven combs in the brood-chamber. The provision of spare combs to the super also is necessary so as to encourage the bees to come up and store honey. If spare combs are not available, the two side combs of the brood-chamber may be taken out, cut to the size of the super frames and fixed on to them.

XIII. **Uniting colonies.** This operation consists of uniting two or three colonies into one and it may be done for mixing a queenless colony with another having a queen, uniting two or more weak colonies to make a strong one. There are various methods of uniting but the simplest, which is popularly known as the "newspaper method," is described below:— The colonies that are to be united are brought side by side (as described under shifting bee colonies) and one of them dequeened twentyfour hours prior to the uniting. Late in the evening the colony having the queen is opened and the top of it is covered with a sheet of newspaper. A few small holes are made in this paper. The floor-board of the other colony is now removed and

the hive is kept over the newspaper. All means of escape are now closed with wire-gauze and the two colonies left alone for the night. The imprisoned bees in both the hives, scenting the presence of strangers, begin to investigate by tearing open the holes in the newspaper and by this time the hive-odor gets amalgamated and the union of the two colonies is accomplished. The wire-gauze at the entrance of the lower hive can be removed early next morning. The hives can be opened after the weather gets brighter and the frames of both the colonies can be kept together.

XIV. **Queenless colonies.** It is very common for colonies to lose their queens during the swarming season. This is due to the queens either getting lost or preyed upon by insectivorous birds during their nuptial flight. The absence of the queen is indicated by the slackness of work in the colony. The workers get their abdomen contracted, turn black in color and they can often be seen remaining huddled together at the entrance. The combs do not contain any worker brood but in most cases, numbers of eggs laid by some of the workers, may be found in each cell. Under such circumstances all the superfluous eggs are removed and even transported to other cells made by the bees. Since the workers are not fertile, the grubs that hatch out of their eggs develop only into drones. The combs get twisted in shape on account of the unequal pressure caused by the presence of the larger drone grubs in the smaller worker cells. In neglected cases numbers of adult drones also will be found. To provide a new queen for such a colony, a comb with a sealed queen-cell from another colony may be given, after driving away the bees adhering to it. The bees may sometimes tear away the queen cells and in such cases a new queen may be introduced by the following method. Dip the queen in honey and drop her into the queenless colony, pouring a small quantity of honey along with her. The workers immediately cluster round the queen and begin to lick the honey. The smell of the latter which attracts the bees, probably neutralizes the individual odour of the queen. Therefore by the time she gets rid of her coating of honey she is accepted by the colony. If the above methods are not successful, the colony may be united with another having a queen. Whatever may be the method adopted, necessary steps to requeen such queenless colonies should be taken, immediately after the loss of the queen is noted, since the bees sometimes refuse to accept either a queen-cell or a queen if there is any undue delay.

XV. **Shifting bee colonies.** Bees have a very strong homing instinct. Powers of good perception and a strong memory of the landmarks enable them to fly back to their hives with unerring exactness, from their foraging excursions. When the bees are working briskly, if the hive is moved even by a few inches, it takes a little time

for the returning foragers to find out the entrance. If the hive is moved by four or five feet, the bees returning with pollen and nectar persistently hover about the original place until they drop down and die of exhaustion. Therefore if the hive is to be shifted from one place to another within the apiary itself, the moving should be done after sunset by about two feet per day. If it is necessary to shift the colonies to a distance, the entrance is closed with wiregauze after nightfall and the hive taken to the desired place and the entrance opened. The minimum distance to which the bees can be moved, without any of the workers returning to the original place, is about half a mile. Frequent shifting of bee colonies should be avoided, since, it always entails the loss of a number of bees.

XVI. **Honey and its extraction.** Bees generally collect nectar from flowers, convert it into honey and store it in their cells. After the cells are filled with the requisite quantity of ripe honey, they are sealed with wax. Honey should be extracted only after 75% of the cells are sealed. Prior to the extraction, the bees that are found adhering on the honey combs may be driven away by the following method. The frames are to be taken out and kept in an empty hive without the top and the floor-board. The box is held in such a way that the top of the front side of the box is just touching the end of the floorboard and smoke is applied from below. The bees, being frightened by the smoke will all rush into the hive. After driving away the bees, the sealed combs should be uncapped with a sharp knife and the honey extracted in the honey-extractor. The latter consists of a cylindrical drum and a box to hold the honey combs. The box is fixed to a rotating rod at the centre and the revolution is effected by the action of a set of two gear wheels on the central rod. The frames containing honey are kept in the slot provided in the comb-box and the latter is rotated. After the honey on the outer side of the comb is extracted the frame should be reversed and the honey on the other side taken in a similar way. The box should be rotated gently at the beginning and the speed increased after the weight of the combs is reduced. Heavy combs are likely to break if the rotation is too fast at the beginning itself.

XVII. **Ripening and Storing of Honey.** Ordinarily bees seal the sells with wax as soon as they are filled with "ripe honey", but occasionally they take a long time to close the cells. In such cases, the honey can be extracted before the sealing, but it has to be ripened artificially prior to storing, as described below:—

The honey has to be poured preferably in an enamel or earthen vessel and the latter kept in a water-bath. The water should be heated up to 150°F., and maintained at that temperature for about half an hour. The water should not be allowed to boil nor can honey be heated directly over fire. The ripening can also be done by

exposing the honey in a wide mouthed vessel to the hot sun for about a week. The mouth of the vessel may be covered with a piece of thin cloth to keep off dirt etc. The ripened honey is best stored in glass or enamel or earthen vessels. The receptacles should be closed tightly and kept in a cool and dark cellar.

XVIII. **A few hints for amateur bee-keepers.** The following hints may be useful for beginners in maintaining their apiaries successfully:—

1. Make the bee hives without cracks and crevices so as to prevent the wax-moth from laying eggs in these.
2. See that the measurements of and spacing in the frames are correct. Any error will induce irregular comb construction.
3. Hive wild colonies during the brisk breeding season since colonies caught during the slack season invariably desert.
4. Locate apiaries in places where pasturage conditions are favourable.
5. Keep the hives absolutely level in a place well protected from the midday sun, rain and high winds.
6. Do not disturb newly-hived colonies frequently.
7. If there is not sufficient honey flow, feed new colonies with dilute honey in the absence of which sugar syrup or jaggery solution may be used.
8. Give the food inside the hive. If the food is kept outside the hive, it often leads to fighting and robbing among bees. Do not over-feed the bees.
9. Examine colonies during bright mornings when bees are busy; otherwise they might sting badly. When stung do not pull out the sting but scrape it off immediately. Rub some green leaf over the part stung to cover the smell.
10. Avoid all jerky and nervous movements while handling bees.
11. When bees are in a bad mood a few whiffs of smoke would quieten them.
12. Do not shift colonies from place to place frequently.
13. As the colony increases in strength, provide additional egg-laying space for the queen by giving foundation or old combs.
14. When brood chamber is full, give super with combs.
15. During the heavy breeding season, be on the look out for queen-cells and for the subsequent issue of swarms. Allow the prime swarm, if it issues early in the season, and hive it as a separate colony. Do not allow any "after swarms."
16. Build up the strength of the colonies prior to the honey season by swarm prevention, requeening, uniting weak stocks, and by provision of breeding facilities.
17. Extract honey when 75% of the cells are sealed and ripen the honey artificially. Do not extract the honey from the brood-chamber.

18. Beware of the wax-moth the worst enemy of the honey bee. To control it keep the colonies strong. Remove all superfluous combs and give just enough for the bees. Examine the joints and interspaces of the hive body for eggmasses of the wax-moth. Scrape away the eggmasses and if necessary change the hive-body once in 6 days. Examine the combs and floor-board of the hive for caterpillars. Store the old combs in an air-tight and insect-proof receptacle. Examine them frequently and if infested by the worms dry them in the sun and eliminate the caterpillars.

19. The black ant is another serious enemy; treat the ant holes with calcium cyanide. Provide ant pans or smear the legs with Tanglefoot.

20. The yellow banded wasp is also known to attack bees. Handnet the wasps. If possible destroy their nests.

Detailed information on the subject of bee-keeping is given in Bulletin No. 37 of the Madras Agricultural Department. For further information the Government Entomologist, Lawley Road P. O., Coimbatore. may be written to.

Research Notes.

The Relationship between the Mechanical Tissue Brown Factor and the Factor for Juiciness of Stalk in Sorghum.

In a previous paper[1] the occurrence, as a mutant, of a sorghum plant with brownish purple-lined internode, leaf-sheath, midrib, panicle branch, and glume top has been recorded. The pigment was not anthocyanic. This mutant behaved as a simple recessive to the common more economic green-internoded and white midribbed plant. A factor mt_b gives a mechanical tissue coloured brownish purple. Mt_B gives the ordinary green internode of the common sorghum.

In another paper[2] Mendelian di-hybrid segregations for the character pairs pithy and juicy stalks (D-d), and not sweet and sweet stalks (X-x) proving them independent in inheritance have been reported.

To determine the inter-relationship between the colouring of the mechanical tissue and such an important factor as juiciness in stalk, crosses were made between the following parents.

A. S. 545	*A. S. 3641*
Sweet Stalk (x)	Sweet stalk (x)
Juicy stalk (d)	Pithy stalk (D)
Mechanical tissue colourless (Mt_B)	Mechanical tissue brownish purple (mt_b)

The F_1 (A. S. CCXXII—a) was sweet stalked (xx), pithy stalked (Dd) and its mechanical tissue was colourless ($Mt_B - mt_b$) In the F_2 the following di-hybrid segregations were obtained.

Family No.	Pithy stalked (DD & Dd) (White midrib)		Juicy stalked (dd) (Dull midrib)	
	Mechanical tissue not coloured	Mechanical tissue brownish purple	Mechanical tissue not coloured	Mechanical tissue brownish purple
A. S. 4765	71	24	26	8

It will thus be seen that the pair of factors Mt_B - mt_b determining the colour-less-ness or brownish purple of the mechanical tissue are independent of the D-d factors determining pithiness or juiciness of stalks—(white or dull midrib in leaves). Juicy stalks with their mechanical tissue coloured brownish purple have been extracted and fixed as types.

References.

1. Inheritance of Characters in Sorghum—The Great Millet, VIII. A Brownish Purple Mutant. *Ind. J. Agri. Sci.* VI (II), 1936. Pp. 481—483.

2. Mendelian Segregations for Juiciness and Sweetness in Sorghum Stalks. *Madras Agri. J.* XXIV (7), 1936. Pp. 247—248.

Millets Breeding Station, Coimbatore, April 7, 1937.

G. N. Rangaswami Ayyangar.
A. Kunbi Koran Nambiar.

Agricultural Jottings.

BY THE DEPARTMENT OF AGRICULTURE

Malting of cholam as a cottage Industry. Investigations of the Government Agricultural Chemist and his collaborators at Coimbatore have shown that it is possible to make excellent malt and malt foods out of cholam.

The Imperial Council of Agricultural Research sanctioned a scheme in 1935 with the triple object of finding more extended use for cholam, which occupies about 5,000,000 acres in our presidency, establishing cholam malting industry both on a small scale and large scale, and eventually to replace partially imported malted foods, on which a large amount of money is being spent.

Laboratory experiments have shown that foods of a great variety and a high solubility can be made out of cholam malt, but in this note the preparation of a simple kind of malt food from cholam is outlined. This can be tried in every home.

Cholam is soaked for a day in pure drinking water which has to be changed at least four times to allow proper aeration of the seed. The grain is allowed to sprout in a cool place in a room for three to four days until the rootlets are about ¾" long. After drying in the sun, the husk and sprouts are carefully removed by pounding in a wooden mortar. The husked, unbroken grain is gently roasted in a roaster or frying pan till a characteristic aroma is given out. This treated grain is called malt which can be crushed and sieved to get fine flour. The coarse fraction can be crushed once again to get second grade malt flour.

Conjee prepared out of the cholam malt flour with milk and sugar added to taste, would make a beverage which has practically all the beneficial effects of any other malt. During the sprouting of cholam active substances like diastase are developed, which digest starch into malt-sugar and break down partly the

protein and fat. The net result is the formation of easily digestible material useful for infants and invalids whose digestive powers are weak.

Agricultural Exhibitions. The extent to which actual cultivators take part in exhibitions organised by the Agricultural Department may be said to be an indication of the increasing touch of the departmental staff with the ryots of the district. At the sixth Vizagapatam District Agricultural Exhibition held at Etikoppaka in January last, a very large number of ryots from all over the district including the taluks added from Ganjam District sent in their exhibits and competed for certificates and medals. The character of the exhibition has during the past six years changed considerably from a more or less departmental show to one in which ryots who follow departmental advice show their best produce for the benefit and emulation of other ryots.

Another feature of this exhibition was that it was held under completely rural conditions in the farm of Rao Bahadur C. V. S. Narasimharaju Garu, where sugarcane (10 varieties), plantain (30 varieties), green manure and other crops were grown on improved lines for the occasion, besides demonstrations in the methods of conservation of manure, different improved implements, pumping machinery, cream jaggery manufacture. The visitors were predominently agricultural and took keen interest in the show and demonstrations, a number of lantern lectures and a radio entertainment having been also arranged for their education and amusement.

Some improvements in paddy cultivation. At Palur Agricultural Research Station in the South Arcot District, experiments were conducted on paddy in regard to methods of sowing and planting, varieties and manures.

Whether the crop is broadcasted or transplanted, a very large quantity of seed is used. Experiments were therefore devised to find out the number of seedlings to be planted in each hole and the maximum distance between any two to obtain the best results. These experiments were tried for five years and it was found that better results could be obtained by planting one or two seedlings than the usual method of planting in bunches. It was also found that samba seedlings 30, 40 or 50 days old and planted 6 inches apart yielded practically the same. With regard to seed rate in the nursery 2½ lbs. in one cent gave the best result.

Manurial experiments were carried out for fourteen years to test the different green manures and bulky organic manures in comparison with oil cakes. The experience gained during this long period went to show that the physical condition of the soil was greatly improved by the incorporation of bulky organic manures and thereby increased the yield. The advantage of the application of cattle manure to wet lands was practically inappreciable. Further the plots manured with *erukkam* and other tree leaves gave 200 lbs. more yield per acre than those manured with oil cakes. Hence ryots who own dry as well as wet lands will do well to apply cattle manure to dry lands and raise green manure crops in the wet lands for manuring paddy.

With regard to the several green manures, there was not much difference among them although Daincha produced the highest yield.

Daincha was grown in a field continuously for 15 years. By this method the mechanical texture of the soil was greatly improved and the alkalinity removed. This was evident by the increased yield obtained gradually year after year from 2,282 lbs. to over 3,900 lbs. per acre.

To find out whether green manures are to be supplemented with phosphatic and potassic manures, trials were conducted for about eight years in both single and double crop wet lands. The results showed that in order to obtain a fair yield, the application of green manure alone would generally solve the

problem. But there is certainly an advantage in the application of bonemeal although the effect is not very perceptible. It was found that in the case of single crop lands the increase in yield by the addition of bonemeal and potash was only slight but in double crop lands the addition of bonemeal at 1 cwt. per acre gave a slightly better yield than green manure alone. But the residual effect of phosphatic manures was always evident in the succeeding crop.

Bone guano and Kossier phosphate were compared with bonemeal to supply the phosphates to paddy and bonemeal was found to be superior to the other two by about 4%.

In order to see if better varieties could be substituted for the local varieties, several experiments were carefully conducted in different seasons. At present Aduthurai No. 12 for the first crop season, G. E. B. 24, Local garudan samba No. 43 and Aduthurai Nos. 1 and 2 for the samba season and Coimbatore No. 2 for the second crop season are being introduced and are finding much favour with ryots.

The Deputy Director of Live-stock informs us that the cow No. 95 H. bred by the Agricultural Department died at the Guntur Veterinary Hospital on the 2nd April 1937. She was reported to be the best milker among the Ongole cows milk yields of which have been recorded so far.

Her history is given below

Born ... ... 18—10—1925.
Sire ... ... No. 20.
Dam ... ... No. 32.

Yields :—

Lactation.	No. of days in milk.	Milk Yield lb.	Daily average lb.	No. of days dry.
1st.	342	4260·4	12·5	189
2nd.	213	5510·5	17·6	90
3rd.	334	7190·5	21·5	60
4th.	348	5765·6	16·6	220
5th.	219	4075·8	18·6	139
6th.	266	4841·7	18 2	160
7th.	157	2843·3	18·1	...

EXTRACT

Science and Practice of Agriculture in India. (Extract of the Presidential address given at the Agricultural Section of the Indian Science Congress 1937). By Rao Bahadur B. Visva Nath, F. I. C., F. N. I.

Soils. The work on soils has for its ultimate object the maintenance of the high productive capacity of soils which are rich, the restoration to normal those whose capacity has been reduced and to effect an appreciable increase in the yield of soils which are naturally poor. * * * * *

The important and common characteristics of the majority of the soils are that they are old, have reached a stage of minimum cropping capacity, are subject to intense sunlight and extremes of temperatures and are alkaline in reaction. Soil work in the beginning was, as would be expected, confined to problems of soil fertility. In recent years, the scientific study of the soil has received considerable attention. The work and experience of over a quarter of a century have brought into prominence certain factors which are of special interest.

In the majority of cases, the characteristics and reactions of soils are determined more by climatic factors than by geological origin. For example, the

so-called black cotton soils, though of different geological origin, have several important soil characteristics in common. The soil profile does not appear to have the significance that it has elsewhere, probably due to age and to the fact that the majority are transported soils. In several cases, the surface horizons are missing, due probably to erosion through centuries. The profile study is, however, of considerable importance in the field study of the soil as a whole. Such a study has been able to solve the puzzle in regard to the downward movement of water in stiff black cotton soils. It has been ascertained that minute cracks are responsible for the downward and lateral movements of water.

* * * * *

Soil-Cultivation. We were taught in the olden days that surface cultivation helps to decrease evaporation and on this basis the better growth of crop in cultivated fields was explained. Recent research has shown that surface cultivation does not help to conserve moisture, but does not explain its effect on crop growth. Likewise, the object of deeper cultivation was stated to be better aeration of soils. Leather's work shows that gaseous exchange occurs in soils normally to a depth of one foot. * * * There is evidence that frequent and deep cultivation is harmful to the soil and to the crop. This is in opposition to what we have been taught but is in agreement with the practice of the cultivator who, except at great intervals of time, does not ordinarily cultivate his soils deeply, nor is he willing to carry out too frequent cultivations of the surface soil. * * * * Recent experience in England also has raised doubts whether deep cultivation or intensive cultivation is really and always good. In an experiment in 1932 in England, neither potato nor sugar beet responded to more intensive cultivation than was necessary to keep down weeds. Indeed, further cultivation beyond this minimum amount did more harm than good. * * * * The effects of cultivation must, therefore be looked for elsewhere. One accepted advantage of cultivation is that it contributes to tilth and crumb structure in soils. The satisfactory formation of soil crumbs due to the aggregation of smaller particles by cultivation depends on the stability of these aggregates towards water. The more stable they are the better they will be from the point of view of crumb formation. In the light of modern work on soil clay, crumb formation and its stability depend on the cationic composition of the clay. It is greater and better for calcium clay than for other clays. The water relationships that exist between clay and water and the salt content of the soil and clay, exercise a direct or indirect influence according to conditions. The intermediate stages between complete calcium clay and sodium clay may have varying degrees of moisture requirements for the use of the plough. The more we understand these factors under different conditions of climate and cropping, the better we shall be in a position to deal with problems of soil cultivation.

Soil-Base Exchange and Related Phenomena. Soil workers are familiar with base-exchange phenomena in soils. This is the greatest achievement of modern soil research which has brought about a revolution not only in the study of the soil, but also in the practical aspects of soil management and amelioration. The conception of the reactive soil particle and of its exchange processes as ionic interactions has given us valuable information in the study of our soils and in understanding their behaviour, particularly in regard to irrigation and the formation and amelioration of alkaline soils. We now know how irrigation water and fertilizer salts can influence the composition and the properties of clay and the soil. We also know that in soils with adequate reserves of calcium, the intensive use of ammonium sulphate does not induce soil acidity. It is on the relative proportions of exchangeable calcium and hydrogen and not on their absolute quantities that the properties of a soil depend and by measuring the degree of saturation, it is possible to assess the field behaviour of a soil under

irrigation or during the rainy season. Attempts to correlate base exchange capacity with crop performance are not yet successful.

* * * *

The composition of the clay complex with respect to cations is of primary importance in determining the soil's ability to absorb water. When saturated with different bases, the moisture holding capacity varies with the base in the descending order, Na., Ca., Mg., and K. The ability to part with water will be in the reverse direction.

The implications of these observations in experiments dealing with water requirements of crops or in the amelioration of alkaline and saline soils is obvious. In the case of the former, the critical and total water requirements of crops will vary even if every other variant except the soil is kept constant. Depending on the nature and quantities of the salts present the amount of water that will be available to the plant will vary. In a salty soil, maize and jowar wilted at over 12 per cent. moisture content in the soil, while in a salt free soil the wilting point under identical conditions was at 7·6 per cent. moisture. In the presence of about 2 per cent. organic matter on the weight of the soil, the position was considerably altered. The difference in moisture content at the wilting point in the two soils was narrowed down to below 1·5 per cent.

The swing of the soil's reaction depends on the degree of moisture in the soil. With soils above pH 7 alkalinity will be in evidence under wet conditions while under dry conditions the same soil will show diminished alkalinity and increaed salinity. From theoretical considerations any calcium salt would be able to effect the necessary exchange reaction but in practice cost decides what should be used. In any case, the presence of organic matter is necessary. From these considerations molasses mixed with any available calcium compound is capable of bringing about the necessary reactions.

Fertilisers and Manures. * * * * The Imperial Council of Agricultural Research has recently collected and collated all the available data on fertilizer and manurial experiments carried out in India in the past. The study of the data on experiments which are sufficiently comprehensive and long enough to justify the view that the results are truly representative, warrants certain broad conclusions. The evidence establishes the suitability and, therefore, the importance to the great majority of Indian soils of indigenous organic manures like cattle manures, green manures, bone manure and fish manure and oil cakes; artificial fertilizers are of importance, but only of secondary importance by themselves, and they show themselves at their best in conjunction with organic manures or when the soil is normally rich in organic matter. In areas of precarious rainfall or inadequate irrigation facilities, artificial fertilizers almost invariably failed to be useful while the effect of organic manures was erratic. With assured moisture supply in the soil, the performance of artificial fertilizers was distinctly better and, in many instances, as good as and sometimes even better than organic manures, according to the nature of the crop.

Among the fertilizers the returns were greatest generally with nitrogenous fertilizers in almost all parts of India. The action of phosphates was evident generally but it was considerable in the crystalline tracts of peninsular India. The response to potassic fertilizers was not appreciable. Of the nitrogenous fertilizers, ammonium sulphate was the most satisfactory but not to such an extent as to rule out concentrated organic manures like oil-cakes, fish manures and hoof-meal. Superphosphates and ammonium phosphates showed themselves to be useful phosphatic fertilizers in combination with organic or inorganic nitrogenous fertilizers. Superphosphate was generally as efficacious or was even superior in some instances to bone meal, but when used alone the action of superphosphate was erratic. Potassic fertilizers were not used to the same

extent as nitrogenous and phosphatic fertilizers. On the few occasions on which they were used, the response was either feeble or none at all, and this experience was perhaps a sufficient deterrant.

In several cases, the continued use of artificial fertilizers only led to bad residual effects on the soil. When used in combination with organic manures, however, the effect of artificial fertilizers was almost the reverse of that when used alone. Higher dosages did result in higher yields, but these were not commensurate with the expense incurred. The evidence in regard to the time of application of fertilizers is neither extensive nor conclusive. What little there is, indicates that the fertilizers are best applied generally in one application at the time of planting for crops other than sugarcane, which prefers applications in two instalments. The next line of investigation should be an experiment and research on the internal and external effects of time of application to the crop. We have as yet not enough data on the proportionalities of N, P, and K, suited to different soils and crops and of the proportions in which organic and inorganic manures should be used.

The average nitrogen content of Indian soils is 0·05 per cent. and of organic carbon content is 0·6 per cent. Similar figures for European soils are 0·15 per cent. nitrogen and 3 per cent. organic carbon. European soils are five times as rich in humus contents and still the demand there is for organic matter. * * The needs of Indian soils are evident and the data from manurial experiments portray the requirements correctly. Cattle manure, green manures and other organic manures are valuable to soils because they supply what is popularly known as humus which is so essential to maintain soil fertility. The cry for organic manures for Indian soils is even stronger and more imperative because the disruption of organic matter is faster at the high temperatures obtaining in India. The rate of destruction can be imagined when it is stated that a soil receiving cattle manure at 10 tons per annum in two instalments continuously for over 20 years, contains only 0·74 per cent. or organic carbon as against 0·59 per cent of organic carbon in a soil that received no organic manure at all.

The theoretical possibilities of artificial fertilizers are almost limitless, but their achievement on the majority of Indian soils is limited by climatic factors and economic considerations. In India the major part of its agriculture depends on the monsoon, and therefore the supply of moisture in the soil is the foremost limiting factor in production. The control of monsoon is beyond our power, but surely we can better conserve and regulate moisture in soils by husbanding the existing resources of indigenous organic manures and using them properly.

* * * *

Soil organic matter is the life of the soil. It improves the physical condition of the soil; it provides organic colloidal material which plays a very important part in absorption and exchange, possessing four to five times the exchange capacity of inorganic colloids in the soil. * * * * Time was when it was supposed that artificial fertilizers had substituted and would continue to substitute natural organic manures, especially farmyard manure, with equal and even greater efficiency. It is now universally recognized that organic manures, exemplified by cattle manure, are necessary for maintaining soil fertility and that no combination of artificial fertilizers can exercise the steadying effect on crop yields from year to year. * * * *

The effect of farmyard manure is seen not only in the total crop yield but also in the higher ratio of grain to straw compared to artificials. In regard to the composition of the crop, there is no significant variation in nitrogen and potash but striking difference is noticed in the phosphate content of the crop from mineral and organic manured plots.

The most striking difference is in the quality of grain as *seed* and food. Ten years ago attention was called by Viswa Nath and Suryanarayana, and McCarrison and Viswa Nath to this important and till then unsuspected aspect of manuring crops. It will be instructive and useful to examine the evidence that has accumulated in this regard since then and to define the position as it now stands. With your indulgence I propose to discuss the work in a little more detail than it has been possible to discuss other lines of activity.

It is interesting to note that although the mechanism of action and the agents responsible for it are under debate, the evidence in the main lends support to the earlier observations on the effect of manurial and fertilizer treatment given to the crop. Repeated experiments by Viswa Nath, subsequent to the first publication, confirm the previous findings in showing that the crop producing quality of the *seed* is influenced by manurial treatment. When seeds from differently manured plots are sown in a soil of moderate fertility the resulting crops are different. The seed from a plot continuously manured with cattle manure gives a better crop than that manured continuously with artificials or not manured at all. Kottmeier (Kuhn, Archiv., 1927) carried out trials to determine the effect of different fertilizers on the *seed* value of potatoes and found that the worst quality *seed* was obtained with physiologically alkaline fertilizers like calcium cyanamide and sodium and potassic manures, while the best all round effects were obtained with farmyard manure or physiologically acid fertilizers like ammonium sulphate. Tallarico (Mem. R. Accad. Ital., 1931) has found that seeds from plants that are overnourished have less vitality than seeds from poor soils.

* * * * * *

Animal nutrition experiments by McCarrison with the identical grains (millet and wheat) as were used by Viswa Nath and Suryanarayana for vegetation tests, showed that grains grown with cattle manure possessed better nutritive value than crops grown with chemical manure or with no manure and that the crop grown with chemical fertilizers was superior to that from an unmanured soil. Subsequent experiments also pointed to the same result. * * * *

The probable causes for the superior effect of organic manures may well be either in the relatively high vitamin contents of the produce, or in the better metabolism in the crop under better moisture conditions due to manure. In some experiments with herbage, Viswa Nath (Annual Report, 1930–31) found that the digestive co-efficients varied with the nature of manuring; herbage raised with cattle manure had a protein digestion co-efficient of 74 per cent., while the figures for the crops raised with mineral manure and no manure were 70 per cent. and 62 per cent. respectively. The animals were fed on equivalent protein basis. Cattle manured herbage had the lowest total nitrogen and soluble ash content. The quantitative effects of nitrogen and mineral contents of the feeds having thus been ruled out, the high protein digestibility of cattle manured herbage points to better availability of proteins and other constituents. In certain preliminary experiments, grain from the unmanured plot yielded the largest quantity of prolamin and that from cattle manured plot yielded the least. The values for the grain in the mineral manured plot have been intermediate. Similar proportionalities have been observed by Bishop whose findings are that low nitrogen content of grain is associated with low prolamin and high salt soluble protein content. It would appear possible that protein metabolism in the plant varied with manurial treatment. * * * *

It would thus appear that if we neglect organic manures and fail to build up the humus content of the soils we shall be doing four things.

Firstly, we shall not be able to maintain the fertility of the soil.

Secondly, we shall not be using artificial fertilizers to the best advantage.

Thirdly, we shall be failing to keep up the inherent cropping power of our improved seed and run counter to the good work of the plant breeder.

Fourthly, we shall be producing food deficient in nutritive value.

* * * * It is therefore justifiable to expect a unanimous acceptance of the proposition that at the back of all improvement lies that of the soil whose organic matter content should be built up by all means in our power.

The Nitrogen Cycle. Soil nitrogen in its several phases has been receiving attention in many laboratories. The results of recent work bring into review the whole of the nitrogen cycle both from the scientific and practical points of view. Dhar and his collaborators have made the important observation and brought forward evidence to show that photonitrification occurs in soils. * * *

An important point on which there is however unanimity of opinion is in regard to photo-denitrification. * * * *

There is besides a considerable volume of evidence in India and elsewhere that loss of nitrogen occurs from the soil in ways other than through drainage and the consensus of opinion is that the loss occurs in the form of elemental nitrogen under dry and swampy conditions. * * In comparative experiments in the field the loss was the greatest with ammonium sulphate, least with cattle manure and intermediate with green manure. The loss was, however, not a continuous process. It was a series of periodical gains and losses of varying degrees of intensity, depending on the nature of the material. The position in the end was that a net loss in total nitrogen was registered with ammonium sulphate, and a net gain with cattle and green manure, the gain being greater with the former. The presence or absence of crop did not make any difference in the nature of the reaction although there was difference in the magnitude of the fluctuation.

Nitrogen fluctuations in the soil are usually explained in terms of the effect of carbon-nitrogen ratios on the biological processes which begin to operate immediately the requisite nitrogen is either put in the soil or is obtained from the atmosphere and any defect in nitrate nitrogen is placed to the credit of the concerned micro-organisms. On this basis it is difficult to explain the loss of total nitrogen. * * * *

Some recent laboratory investigations with soil cultures using sugar only in one set and nitrate only in another and a third in which sugar and nitrate are used together, show that regardless of the initial C : N ratio, the loss of carbon is fairly constant amounting to about 70 to 80 per cent. of added carbon, the ratio ultimately assuming a value round about 10. With sugar alone, loss of carbon was associated with gain in nitrogen, the latter obviously being obtained by fixation from the atmosphere till the ratio reached 10. With only nitrate the changes in the carbon and nitrogen were too small to be significant. When, however, sodium nitrate was substituted by ammonium sulphate, it was converted into nitrate with a loss of ten per cent on the total nitrogen. * * * *

What is the meaning of all these changes? What is the significance of nitrification? If crops feed in the form of nitrates, why should there be loss of nitrate and nitrogen? Is it possible that the capacity for nitrification is simply an index of the soil's respiration efficiency? What is the relationship between nitrification and nitrogen fixation? Can it be that nitrogen fixation is more intimately connected with the direct feeding of crop and nitrification is a means of rendering oxygen available, and what part does sunlight play in this? Do the results of recent experiments by Subrahmanyan on the action of inorganic oxidizing materials give any clue? These are all intensely interesting questions that arise from a critical study of the recent results and require an answer.

Meanwhile we may examine with reference to practice the problem. Nitrogen is the most expensive of the fertilizer constituents to buy It is surely bad business if it is to be bought and put into the soil only to be entirely or partly lost into the air. Fortunately, however, it is capable of replacement in the soil by natural means. * * * * Comprehensive studies by Rao Bahadur Sahasrabudhe, in the field and in the laboratory, establish that considerable nitrogen fixation occurs sufficient to maintain the fertility of the soils of the arid and semi-arid tracts in the Deccan. * * * Joshi has computed from field experiments at Pusa that under favourable conditions as much as 360 pounds of nitrogen per acre, including that removed in the crops, is gained in the cold and hot seasons.

It is natural to enquire that if such large nitrogen gains are possible, where then is the necessity for adding nitrogenous fertilizers and how additional crop responses are possible on the mere addition of 20 or 30 pounds of artificial nitrogen. If the conditions in the majority of Indian soils are favourable for nitrogen recuperation, the same conditions, namely sunlight and temperature, help to destroy the organic matter of soil which produces a disturbed physical condition in the soil soon to be followed by all other inevitable consequences. Under such circumstances the addition of small amounts of artificial nitrogen probably helps, partly at least, in assisting the recovery of physical and biochemical conditions. The natural process of nitrogen recuperation depends for its success on the sufficient organic matter-supply in the soil.

Recent experience at the Kansas Experiment Station points in the same direction.

The Problem of Organic Matter and Manure Supply. * * * * It is computed that under our conditions about 75 per cent. of the fresh organic matter added to the soil and about thirty per cent. of the stabilized humus are destroyed annually. The position calls for investigations on the means both for conserving organic matter that is already in the soil and for increasing our resources of organic manures.

By carefully storing the dung, urine, litter and other refuse material, it is possible to conserve this source of supply. * * * * However carefully it is preserved and its quality improved, we cannot get enough of it to meet the requirements. Composting all waste vegetation is another means by which the supply of farmyard manure can be supplemented.

The problem of composting has been receiving considerable attention at the hands of agricultural workers in India. These endeavours have always been to develop a technique suitable to Indian conditions. * * * * The changes in the details of the technique during the last few years are indicative that the process of composting is still open to further studies.

It would appear that it is the organic matter of the compost or of the manure that is more important than its nitrogen components, its loss of nitrogen does not seem to be an avoidable factor which depends on the initial richness of the basic material used for the compost. It would also appear from a study of temperatures that the process is both chemical and biochemical consisting of a low temperature period of chemical oxidation and a high temperature period of biochemical oxidation. Both the processes proceed side by side, the one or the other being a predominant feature for the time being. The low temperature fermentation seems to be more in evidence after the high temperature fermentation is over and when the apparent stabilized stage is reached. It is possible that the reinforcing of these composts with nitrogen and phosphate at the end of the fermentation period is likely to render fertilizer usage more valuable than it is now. * * * While many of the methods proposed are workable on plantation basis, their suitability to the peasant cultivator is doubtful. If composting is to form a regular agricultural practice in India, it is necessary that

efforts should be made to make the method simpler and cheaper than what it now is.

* * * * The possibilities of utilizing the vegetation of forest areas for supplying cheap fuel in the shape of charcoal and compressed briquets of composted humus, without affecting the requirements of the forests themselves, is a problem worthy of investigation. Vageler has estimated that the yearly production of fresh organic matter in the primaeval or rain forest at one hundred tons per acre as a cautious estimate. For the monsoon forest the estimate is about 20 tons to the acre. The problem is, how much can be spared for the plains. The problem should be viewed and be considered on the analogy of irrigation by which waters from areas of plenty are carried to areas of scarcity.

* * * * * *

Problems of Food and Nutrition. * * * * * A W. Flux, in his presidential address to the Royal Statistical Society (June, 1930) on 'Our food supply before and after war', fixed 86·5 grammes of protein per head per day in England. This is equivalent to 14 grammes of nitrogen per head per day. For India, I have assumed that the food requirements are lower and have taken an everage of 75 grammes of protein consumption per head per day. This is equivalent to 12 grammes of nitrogen. On this basis, the annual requirement of nitrogen, necessary for feeding a population of 353 millions, works out to 1,522,312 tons of food nitrogen for the whole population or 9 66 pounds of nitrogen per head per year. From the 247,000,000 acres under cultivation with various food crops, a total of 1071,138 tons of food nitrogen are available. Thus, we are short by roughly 500,000 tons of food nitrogen. In other words, we are at present producing food sufficient for the proper feeding of only two-thirds of the population.

The supply of food has to be increased by increasing the outturn per acre and by bringing more land under cultivation. With high yielding strains of crops and suitable soil management, it should be possible to increase production sufficient to meet the needs. Our botanists can and are producing high yielding strains which, on the average, give 10 to 15 per cent. increase in yield. A quarter of a century of experimental work has demonstrated that by rational soil management and manuring a further increase of 10 to 15 per cent. can be expected. The results of recent sugar-cane growing competition under the auspices of the Maharashtra Chamber of Commerce, Bombay, show that large increases are not impossible. In these competitions, the Kalamb Sugar Factory harvested as much as 104·28 tons of cane to the acre. Several other factories recorded 80 to 100 tons of cane to the acre as against the normal average of about 40 tons to the acre.

Conclusion. In this brief sketch I have endeavoured to draw attention to some of the outstanding problems, the solution of which intimately concerns agricultural practice. * * * * Great as has been our achievements in the past, we have only laid the foundations for the future. The scientific study of the soil will doubtless enable improvements for the future as it has done for the past, but the utilization of this knowledge to the full will be in proportion to our ability to build up the reserves of organic matter in the soil.

Indian agriculture is one of great antiquity and many of the present-day practices are the outcome of experience through at least fifty centuries. * " * The effect of intensive cultivation and the intensive use of fertilizers in India without the necessary accompaniments is obvious.

Research should concern itself more with details of existing practices than with the evolution of wholly new methods and should aim at building up on the existing system a state of agriculture to suit the condition of the soil and the resources of the cultivator.

Reviews.

Booklet on " Beekeeping " in Tamil by S. Gopalakrishnan, Madras.

The booklet is on the whole well written, presenting the salient points of the subject, in a concise form, with a few illustrations. Its get up is quite attractive and the low price (four annas) as compared with the information contained, is bound to make it quite popular.

The subject is dealt with in 11 chapters, commencing with beekeeping– new and old. The subsequent chapters contain information regarding the life history of the honey bee, the different indigenous varieties, hives and appliances, care and management of bees, swarming, enemies, etc. Information on hiving wild colonies and details of the bee hive are given in two appendices.

As the booklet is expected to serve as a useful guide to amateurs, the following few suggestions, to make it more useful to the public, are offered. A few facts on the bee pasturage plants, breeding season, economics, may be given in the booklet. There are certain statements such as the capacity of the queen to lay 3000 eggs per day, of the capacity of the bees to travel up to 2 or 3 miles, the massacre of the drones, which are not quite correct in the case of the Indian bee. The statement that the pollen basket is in the second joint of the hind leg needs correction.

The portion dealing with the care and management of bees must be more comprehensive, giving fuller details of the various operations including uniting bee colonies, introduction of queen in a queenless colony, which are often necessary while managing an apiary. The portion on swarming—the most important aspect—is too meagre. The portion on bee enemies is too short. The wax moth especially deserves a more detailed treatment and the remedy suggested by the author will hardly be of any use to the amateur. The method advocated by the author for hiving swarms and capturing wild colonies do not seem to be quite practicable ; at any rate, there are better methods which can be suggested.

M. C. C.

Rural Reconstruction. N. G. Apte, B. Ag. (Dairy).

The book is a collection of a few notes and articles prepared by the author at different times during 1931—34 as a result of his investigations into the rural life of Maharashtra. Mr. Apte has spared no pains in making the investigation as thorough as circumstances permitted and as far as it goes the book gives a fair idea of the present-day conditions which rural workers are faced with. The only portion however which will interest the general reader is, in our opinion, that which deals with the possibilities of starting "Fruit preserves" industries wherever facilities exist.

As regards the rest we do not certainly see eye to eye with the author especially regarding some of his generalisations about the causes of the present unenviable position of the Indian villager. Nor are the remedies proposed as convincing as the author tries to make out. The chapter on the village water supply is, if at all, of only local interest.

As a faithful record of the investigations carried out by an enthusiast we commend the book to all those interested in the work of rural reconstruction.

The publication is priced Rs. 2—8 and is available with R. K. Rao, Pallipat, Nagari Ry. Stn., Chittoor Dt.

M. U. V.

College News & Notes.

Honey Week. The celebration at the Agricultural college of the 'Honey Week' that had been arranged for the first time to be observed on a Presidency basis came off on the after-noon of the 24th of last month. Before a distinguished gathering, Mr. R. C. Broadfoot, Principal inaugurated the function at the College Apiary.

Mr. M. C. Cherian, the Government Entomologist, in inviting the Principal to preside on the occasion said that the economic possibilities of bee-keeping as a cottage or subsidiary industry are great owing to its low capital cost and the existence of other natural facilities. The cost of a hive and an extractor, which represent all that are required, would come to only Rs. 8, while at a modest estimate, each hive can be expected to yield about 6 to 8 lb. of honey in the year worth about Rs. 10. He then proceeded to narrate what the Entomological section is doing to popularise the industry. Started in 1931, the Apiary at the college has at presnt 40 hives in working condition, and a great deal of information has been collected regarding the bee-pasturage plants, its enemies and their control. In addition, active propaganda is being made by means of printed pamphlets and by demonstration, at most of the exhibitions and fairs.

Specialised instruction is also being imparted to the sons of farmers in the short courses arranged at the college.

Mr. R. C. Broadfoot, in thanking Mr. M. C. Cherian for the invitation expressed the pleasure it gave him in inaugurating the first 'Honey Week' at the college. The object of this week, he said, was to introduce bee-keeping as a subsidiary industry in rural areas. He recalled how one of his friends in England was making quite a decent living out of 20 hives and by supplying bees and bee-keeping appliances to others. His hives averaged over 100 lbs. of honey per annum, which indicates its possibilities in skilled hands. Honey is being sold in England from 9 d. to 1/- per lb. for ordinary grades and from 1/4 to 1/6 for heather-honey. Conditions in India are considerably more favourable for the industry. Bee pasturage can be had all the year round and there would be little need therefore to feed the bees. Further, good honey fetches somewhere about Rs. 1—12—0 a pound at which rate even small yields of 10 to 12 lb. will prove profitable. Mr. Broadfoot then referred to the facilities available at the college for learning this art and that if specialised training or advice is wanted, the Government Entomologist would no doubt make suitable arrangements. With these words, he declared the exhibition open and in recommending it to all present, announced that the exhibition would be on for a week.

The function came to a close with a vote of thanks proposed by Mr. T. V. Subramaniam, Assistant Entomologist.

B. Sc. Ag. Examination. The following gentlemen were at the College in the capacity of examiners in the recent University examination. Mr. B. G. Appadorai Mudaliar B. A., B. Sc. (Tech.), A. M. I. M. E. for Agricultural Engineering, Rao Sahib Mr. M. Ananta Narayana Rao G. M. V. C. for Animal Hygiene and Mr. K. R. Narayana Iyer M. Sc. for Agricultural Chemistry.

Economic Biologists' Association. There was a lecture by Mr. Percy Kent Norris Cotton Commissioner, Section of Plant Industry, Dept. of Agriculture the U. S. A. on the subject of "The working of the Agricultural Adjustment Act in U. S. A.".

Coronation Honours. We are glad to note that the Government have been pleased to award titles to two of our Departmental Officers in the recent Coronation Honours List, and we congratulate Messrs. Rao Bahadur N. S. Kulandaisami Pillai and Rao Sahib G. Jogi Raju Garu on their well merited distinction.

Weather Review (MARCH 1937).

RAINFALL DATA.

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·3	-0·2	8·1
	Berhampore*	0·7	-0·5	5·1
	Calingapatam	0·3	-0·1	3·5
	Vizagapatam	0·4	-0·1	3·5
	Anakapalli*	2·7	+2·4	5·6
	Samalkota*	...	-0·2	1·6
	Maruteru*	...	-0·0	0·9
	Cocanada	0·1	-0·4	1·1
	Masulipatam	...	-0·3	2·8
	Guntur*	...	-0·2	0·5
Ceded Dists.	Kurnool	0·1	-0·2	1·1
	Nandyal*	0·4	+0·2	1·5
	Hagari*	0·6	+0·4	1·1
	Bellary	0·6	+0·4	1·8
	Anantapur	...	-0·2	0·7
	Rentachintala	0·2	...	1·8
	Cuddapah	0·6	-0·5	0·9
	Anantharajupet*	...	...	2·1
Carnatic	Nellore	...	-0·2	0·7
	Madras	...	-0·2	0·1
	Palur*	2·2	+0·8	3·6
	Tindivanam*	1·8	+0·3	2·2
	Cuddalore	1·3	+1·1	3·2
Central	Vellore	0·4	+0·4	0·7
	Salem	...	-0·5	0·0
	Coimbatore	0·7	-0·2	0·8
	Coimbatore A. C. & R. I.*	2·0	+0·2	2·1
	Trichinopoly	0·4	0·0	0·7

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	0·2	-0·1	4·6
	Aduthurai*	1·1	-0·3	1·5
	Madura	0·5	0·0	0·6
	Pamban	2·5	+0·97	6·7
	Koilpatti*	0·7	-0·2	3·8
	Palamkottah	...	...	...
West Coast	Trivandrum	3·9	+2·3	5·3
	Cochin	1·1	-0·9	2·4
	Calicut	0·2	-0·3	0·2
	Pattambi*	0·5	-0·5	0·6
	Taliparamba*	0·3	-0·1	0·3
	Kasargode*	0·0	-0·5	0·0
	Nileshwar*	0·0	-0·3	0·3
	Mangalore	0·0	-0·1	0·0
Mysore and Coorg	Chitaldrug	0·1	-0·2	0·1
	Bangalore	0·8	+0·2	2·7
	Mysore	0·9	+0·5	1·6
	Mercara	3·6	+3·0	4·7
Hills.	Kodaikanal	2·5	+0·5	4·7
	Coonoor*	6·4	...	13·9
	Ootacamund*	2·1	+1·0	3·4
	Nanjanad*	1·7	+0·7	4·3

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 (published in Fort St. George Gazette).

A wave of low pressure moving westwards across Ceylon has caused wide spread thunderstorms in South Madras.

During the month rainfall is normal in Mysore, and Coorg and hills, below normal in West coast and elsewhere.

Weather Report for Research Institute Observatory.

Report No. 3/37.

Absolute maximum in shade.	...	96·5°F.
Absolute minimum in shade.	...	64·0″
Mean maximum in shade.	...	94·1″
Departure from normal.	...	0·4″
Mean minimum in shade.	...	70·80″
Departure from normal.	...	plus 1·4″
Total Rainfall.	...	2·0″

Departure from normal.	...	plus 1·2″
Heaviest fall in 24 hours.	...	1·41″ (recorded on 19th)
Total number of rainy days.	...	3
Mean daily wind velocity.	...	1·1 M. P. H.
Mean humidity at 8 hours.	...	70·2%
Departure from normal.	...	plus 0·5%

Summary. The mean minimum temperature was above normal by 1·4°F while the mean maximum was about the normal. A rainfall of 1·41″ were recorded on 19th and rainfall was in excess of the normal by 1·2″. The mean humidity was in excess by 0·5%. Otherwise the general weather conditions continued to be normal. P. V. R. & P. G.

Departmental Notifications.

1. Transfers.

Name of officers.	Transferred From	Transferred To
M.R.Ry. T. Paramanandam	Guntur	Nandigama.
„ D. Atchyutarama Raju	Nandigama	Ongole.
„ D. C. Hanumantha Rao	Ongole	Tenali.
„ D. Bapayya	Tenali	Bezwada.
„ M. Ramareddi	Bezwada	Guntur.
„ I. Kurma Rao	Anakapalli	Second Circle.
„ A. B. Adisesha Reddi	Coimbatore	Third Circle.
„ K. Sri Raman	Science Section	Chemistry Section.
„ C. A. S. Ramalingam Pillai	Srivilliputtur	Fifth Circle.
„ P. V. Samu Ayyar	Kulitalai	Srivilliputtur.
„ A. Chidambaram Pillai	—	Dindigul.
„ M. C. Krishnaswami Sarma	Coimbatore	Tirumangalam.
„ A. K. Ganesa Ayyar	Tirumangalam	Ramnad.
„ S. P. Fernando	Dindigul	Eighth Circle.
„ K. C. Thomas	Tiruppur	Central Farm, Coimbatore.
„ T. V. Ayyaswamy Iyer	Tirupattur	Aruppukottai.
„ S. Ponnuswamy Naidu	Sankarankoil	Ambasamudram.
„ S. Bhima Raju	Ambasamudram	Sankarankoil.
„ P. Somayajulu	Maruteru	Buchireddipalayam.

2. Leave.

Name of officers.	Period on leave.
M.R.Ry. T. Paramandam	3 months on m. c. from 20–4–37.
„ K. Suryanarayana	1 month on m. c. from 10–5–37.
„ K. Kuppuswamy	1 month on m. c. from 10–5–37.
„ T. Varahalu	1 month from 1–5–37.
„ V. M. Ramunni Kidavu	3 months on m. c. from 23–4–37.
„ K. Jagannatha Rao	2 months on m. c. from 1–5–37.
„ R. G. Mal	3 months on m. c. from 20–4–37.
„ P. Kannan Nambiar	2 months on m. c. from date of relief.
„ K. S. Krishnamurti Iyer	2 months on m. c. from 10–5–37.
„ T. Rajagopala Iyengar	1 month on m. c. from 3–5–37.

The following officiating appointments in the III Grade have been ordered.

3. Posting.

Name of officers.	Posting.
Mr. Ali Hyder.	Third Circle.
M.R Ry. C. Bhujanga Rao.	„
Mr. James Colaco.	Chemistry Section.
M.R.Ry. S. D. S. Albuqerque.	Nileshwar.
„ C. T. Ittyachan.	Chemistry Section, Coimbatore.
Mr. Joshua Moses.	Sixth Circle.
M.R.Ry. Rajababapaniah.	First Circle.
„ M. Venkataramhiah.	Second Circle.
„ T. Arunachalam.	Sixth Circle.
„ K. Jaya Raman.	Oil seed Section.
„ M. M. Krishna Marar.	Third Circle.
„ K. S. Kutty Mudali.	Sixth Circle.
„ G. Satyanarayana.	First Circle.
„ M. Kasivisvanathan.	Third Circle.
„ M. Lakshmikantham.	First Circle.
„ C. Krishnamurti.	Third Circle.
„ G. Narasimhamurty.	Third Circle.
„ D. Satyanarayana.	First Circle.
„ G. Satyanarayana Rao.	Third Circle.
„ K. Adinarayana Rao.	Second Circle.
„ G. Vekata Sastry.	First Circle.
„ A. Subba Rao.	Second Circle.
„ K. Sri Raman.	Third Circle.
„ B. Suryanarayana Murthi.	Second Circle.
„ G. Kameswara Rao.	First Circle.
„ Ranganathachari.	Third Circle.
„ V. G. Venkatarama Rao.	Second Circle.
„ V. S. Rangacharlu.	Third Circle.
„ G. V. Vekataramana.	Second Circle.
„ N. Ragava Rao.	Agricultural Research Station, Anakapalli.
„ S. V. Parthasarathi.	Second Circle.
„ P. Ramanatha Rao.	Second Circle.
„ A. Raghavan.	Third Circle.
„ S Sangameswara Sarma.	Anakapalli.

Promotion.

The following promotions of Upper Subordinates in Class I, Madras Agricultural Subordinate Service, in the *Science Section* are ordered :—

(i) M.R.Ry. K. M. Thomas Avl., Assistant in Mycology, II Grade (Rs. 225/-) to I Grade Rs. 250/- without prejudice to his appointment on probation in the Madras Agricultural Service—to take effect from *16th December 1935.*

(ii) M.R.Ry. Samuel Jobitha Raj Avl., Assistant in Paddy, from III Grade (Rs. 200/-) to II Grade Rs. 225/- without prejudice to his officiating appointment in the Madras Agricultural Service—to take effect from *16th December 1935.*

(iii) M.R.Ry. C. V. Sundaram Avl., Assistant in Entomology, from IV Grade (Rs. 120—10—170) to III Grade (Rs. 200/-) to take effect from *26th February 1936.*

(iv) M.R.Ry. S. Ramanujam Avl., Assistant in Paddy (on leave) from V Grade Rs. 85--5—120 to IV Grade Rs. 120—10—170 to take effect from *22nd May 1936.*

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SCENT IN RICE

By K. RAMIAH.

Among the hundreds of rice varieties under cultivation in different parts of India, there are a few known as "scented rices" forming a group by themselves. The variety *sukadas* cultivated in Northern and Western India and the variety *rascadam* cultivated in parts of Madras are typical examples of such scented rices. These scented rices emit a peculiar smell, very similar to the scent of the flower of '*ilupai*' (*Bassia longifolia*) tree which finds favour with some people who grow these rices specially. The scented rices are particularly in demand by the Muhammadans in South India who cook them with meat. The special quality of fineness in rice which chiefly refers to the size of the grain has apparently no relationship with scent, as scented rices can be either fine or coarse. But a rice which is fine as well as scented like the *rascadam* of Madras gets a premium of 25 to 50 per cent in the markets over the ordinary rices.

Among the large number of rice collections, (over a thousand), available with the Paddy Specialist, Madras, there are about a dozen scented rices. They vary in grain size, colour of glumes and in flowering duration just like ordinary rices. While the majority of the scented rices are white and non-glutinous, there is also a dark purple (black) glutinous rice that is scented. The experience in Coimbatore has been that the nature of scent is practically the same in all the varieties, there being only slight differences in the intensity of the scent.

It is not definitely known in what part of the grain the scent is concentrated nor to what active principle the scent is due. While the so called scent in rice is invariably associated with the smell that emanates when the rice is being cooked, it is possible to recognise the scent even when the empty husk of the scented rice is boiled in water. The scent, when sufficiently strong, can also be made out by masticating a few husked grains in the mouth. It has been the experience in Coimbatore that the characteristic scent can be detected even when one walks along the bund of the field where a scented rice is growing, particularly when the variety is in flower. The scent at this time emanates, in all probability, from the dehiscing anthers.

That the presence or absence of scent in rice is a Mendelian character often inherited independently and occasionally associated with

other characters was evident from some of the earlier work done at the Paddy Breeding Station, Coimbatore. A brief account of the information then collected, though it was neither extensive nor conclusive, is given here just to show that it is possible to breed varieties with scent by hybridisation, if there should be any demand for a scented rice of a particular kind in any special locality. Though the smell of the strongly scented rices is not favoured by everyone, there is no doubt that a small amount of scent present in an otherwise fine rice would be appreciated and would command a premium in the market.

In the varietal plot where a number of rice varieties are grown adjacent to each other there is a fair amount of natural crossing among them which can be easily detected in the F_1 generation. In one year a large number of such crosses occurred in the plot of variety *rascadam* mentioned before. These crosses were isolated and grown separately in the following year mainly with a view to study the inheritance of glume colour. Since this variety was growing in the midst of nonscented rices, it was decided as an after-thought to examine the F_1s for the inheritance of scent as well. After the plants had been examined in the field for glume colour, the heads from some of the families were collected individually and stored in paper covers in the laboratory. An opportunity to examine them for scent did not present itself until a year later.

The procedure adopted for the test was as follows:— A few grains from each panicle were first crushed in an ordinary porcelain pestle and mortar, put into a wide mouthed boiling tube and boiled with water over a Bunsen burner for a few minutes. As soon as the water started boiling, the scent, if it was present. could be easily smelt. It was possible not only to differentiate the scented from the non-scented, but also to distinguish slight differences in the intensity of the scent. While the scent was quite as strong as in *rascadam* in some varieties it was distinctly lighter in others. An attempt was first made to have three groups in the classification, scented, lightly scented and non-scented but it was later reduced to two groups only, scented and non-scented, because of the obvious limitations in the technique followed in the test. Though as far as possible all the testing was done by only one or two individuals, personal equation did play a considerable part in the classification. Moreover after a few boilings had been made, the whole room got impregnated with the special scent and it was a problem to distinguish the non-scented from the scented. There was also an additional disadvantage in that the panicles inside the paper bags, for want of proper care in storing, had been attacked by the rice moth. Such moth eaten grains emitted a special odour often making the classification difficult. The ratios of scented to non-scented obtained are given below.

Natural crosses in *rascadam*. Family number.	Scented.	Non-scented.	Ratio of scented to non-scented.
625	192	151	1·3:1
626	423	206	2 1:1
627	191	90	2·1:1
628	333	205	1·6:1
629	462	214	2·2:1
634	273	106	2·6:1
636	272	187	1·5:1
637	206	90	2·3:1
638	263	73	3·6:1
Selections from			
family 637 ; 995	694	299	2·4:1
do. ; 996	474	187	2·5:1

The ratios are so variable and it is not possible to make out the number of factors responsible for scent and it is not surprising if one recognises the limitations of the test employed for the studies. One or two of the families would appear to indicate a single factor difference between the scented and the non-scented groups like 634 and 638 but in the others apparently more than one factor is involved. That the ratios obtained for glume colours were quite different in these two families as compared to the rest gives additional proof that the parents concerned were different. The actual hybrid plants (F_1s) were not unfortunately examined for scent but an opportunity that presented itself later was utilised to examine the F_1s of a cross between *rascadam* and a non-scented rice and it was observed that the F_1 did have scent though it was not quite so strong as in the *rascadam* parent.

Later some of the progenies, F_3s, of a cross between a dark purple (black) glutinous and scented rice and a red, non-scented and non-glutinous rice were examined for the character of scent. The cross was intended mainly for the study of the inheritance of colour of rice and the glutinous character of the endosperm; but the study of scent came in incidentally. As the plants were being examined in the field for rice colour and rice endosperm character, an attempt was made to classify them for scent by chewing a few grains of each plant as they were being crushed for rice examination. Although the chewing test cannot be considered quite as reliable as the boiling test, the ratios obtained in three of the families are given below :—

Families.	*Scented.*	*Non-scented.*	*Ratio.*
2489, 2492 and 2493	247	106	2·3 . 1

To be sure of the ratios, two other families were harvested individually in paper covers and later examined for scent in the laboratory by boiling tests. The ratios obtained in these two families are as follows :–

Family.	Scented.	Non-scented.
2485	41	29
2488	121	80
Total.	162	109

The ratios would appear to indicate a 9:7 ratio more than anything else. In the case of family 2488 the tabulation for scent was done along with the colour of rice which gave some interesting results.

	Rice colour.							
	Various degrees of purple & red *PR*		Various degrees of purple and white—*Pr*		Red *pR*		White *pr*	
	1		2		3		4	
Scented.	85	*72*	9	*19*	26	*22*	1	*8*
Non-scented	35	*48*	22	*12*	11	*15*	12	*5*

Previous work in Coimbatore had shown that a cross between purple rice (Pr) and a red rice (pR) gives 12 purple rice (PR and Pr), 3 red rice (pR) and 1 white rice (pr). The expected ratios for scent in the above family on the basis of independence of the factor or factors responsible for scent from those of the rice colour factors are given by the side in italics. X^2 test would show that the deviations of the observed from the expected to be quite significant in groups 2 and 4 i. e., wherever r (factor for white rice) is present 'there is a preponderance of scented rice. In the absence of definite knowledge about the number of genes responsible for scent it is not possible to determine the linkage values' but it can be stated that there is some association between white rice and scent.

Summary. Scented rices are characterised by a special smell emitted at the time of boiling the grain. Such smell is found to be present even in the empty glumes and the dehiscing anthers. The scent is found to be a Mendelian character controlled by either one or probably two factors. In one of the hybrid progenies examined there is found an association between scent and colour of rice.

AN UNRECORDED ECONOMIC PRODUCT

Decalepis Hamiltonii, W. & A. Family: Asclepiadaceae.

By K. CHERIAN JACOB, L. Ag., F. L. S.

Tamil: Mahali Kizhanku; Kattu Nannari.
Habit: A climbing shrub.
Habitat: Crevices of rocks.
Distribution: Anamalai Hills (Coimbatore District); hills of North Coimbatore; Kambakkam Hills (Chingleput District); Velikonda Hills (Nellore District); Madanapalle (Chittoor District) and Horselykonda (Cuddapah District).

The fleshy roots of the plant are medicinal, valued as blood purifier and appetiser and also largely used for making pickles in the Coimbatore and the Malabar Districts. But peculiarly enough no mention has been made of the plant in any of the various books dealing with the economic products of India.

The plant is a twining shrub. The young branches are nearly smooth except for a few scattered emergences. Old branches are thick, about an inch across and are characterised by a fissured condition of the rind. Leaves are about 1″—1½″ across, opposite, leathery, almost round or ovate, with usually a round tip and six pairs of arched veins. Flowers small, in axillary pendunceled cymes; calyx deeply penta—fid; corolla rotate, lobes five, valvate, white, villous within; stamens at the base of the corolla; ovary of two, many ovuled carpels; fruit of two thick lanceolate, short follicular mericarps; seeds ovate, ridged, tipped with a white coma. Fruits in pairs each 2½″ long and 0·7″ in diameter at base and tapering above. Roots are brittle, 3′—4′ long and attain diameter of even ¾″--1″. The core is woody enclosed in a thick fleshy coat. It is this fleshy coat that is used for pickling. The flavour is very similar to that of *Hemidesmus indicus, R. Br.* (Country Sarsaparilla; Tamil: *Nannari*).

Market. It is available for sale in the Pollachi shandy (Coimbatore District) throughout the year. From Pollachi it is exported to Calicut, Palghat, Udumalpet and Coimbatore. At Coimbatore it is available in fairly large quantities at about 1 to 2 annas per pound.

Method of pickling. The roots are thoroughly washed and the central woody core is removed by splitting and discarded. The fleshy portion is then cut into small cubes of ⅛″ and is mixed thoroughly with pounded chillies and salt. The whole stuff is soaked in lime juice (*Citrus acida, linn.*) and preserved in porcelain jars. In this condition it can keep well for over a year. The quantity required for daily use is taken and a little buttermilk is added before use.

AGRICULTURAL ZOOLOGY

With special reference to S. India.

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Lecture No 2.* **Agricultural Entomology.**

In my last lecture I gave you some idea of the economic importance of the different animal groups from the lowest organisms (Rotozoa) to the highest evolved group of animals (Mammals), especially from an agricultural point of view. I shall deal now with the different aspects of the Arthropoda in their relation to the S. Indian farmer, with the help of diagrams and slides, which in a subject like this, will be far more effective and telling than a torrent of the most carefully selected adjectives. I may state at the very beginning that the animals included in this big sub-kingdom of animals (Arthropoda)

* Lecture No. 1 appeared in the March issue of this journal and was delivered under the auspices of the University of Madras—Maharajah of Travancore Curzon lectures on Agriculture. The lecture was illustrated with lantern slides.

play a far more important role in the economy of man than most others and from the point of view of harm they cause to the farmer and layman, this group surpasses in importance every other animal community in the world.

The most important features of the Arthropoda consist in their bodies being made up of a series of ring like divisions or segments arranged one behind the other like the segmented worms, and their paired limbs which vary in number, being made up of different pieces or joints—hence their name (*Arthropoda*=with jointed legs). This great group includes the subdivisions shown below.

Important characters of the chief Arthropod classes.

Class.	Antenna or feeler.	Legs.	Body divisions.	Eyes.	Remarks.
1. *Onychophora* (only *Peripatus*).	One pair.	Many pairs of unjointed legs.	No clear divisions.	Two simple eyes.	Aberrant lowly organised group with characters connecting segmented worms and Arthropoda. Possess both nephridia and trachael vessels.
2. *Crustacea* (crabs, prawns, wood lice, etc.)	Two pairs.	Many or at least five pairs.	Two—(Cephalothorax and abdomen.)	Compound (often stalked).	Mostly aquatic forms with gills.
3. *Arachnida* (scorpions, spiders, mites and ticks).	No Antenna	Four pairs only.	Two—(Cephalothorax and abdomen) or no divisions.	Simple eyes.	Land forms with lung like structures for breathing. Chiefly carnivorous, some plant feeding.
4. *Myriapoda* (centipedes and millipedes).	One pair.	Numerous one or two pairs to each segment.	Two—(head and the lung trunk).	Simple eyes or clusters of simple eyes.	Worm like long forms. Land animals.
5. *Insecta* (Insects).	One pair.	Only three pairs (hence called *Hexapoda*)	Three distinct regions—(head, thorax and abdomen).	Compound eyes and very often simple eyes also.	Wings present in many air breathers. Found chiefly on land though some are aquatic.

From an Agricultural point of view the *Crustacea* are of little importance excepting for some crabs pests. Fresh water crabs of different species (*Paratelphusa*, *Potamon*, *Varuna* etc.) give some trouble in paddy fields, especially in some of the delta areas. These attack young rice plants and cause severe damage during certain seasons, destroying over 50% of the seedlings which are cut at ground level and removed to the crab holes where they are chewed. The next group—

Myriapoda—is also of little importance in that direction. Occasionally species of Millipedes (*Julus* etc.) have been found to attack ripening groundnut pods under the soil; the creatures feed on the seeds and leave the pods empty. The group *Arachnida*, however, plays a more important economic role than the two groups noted above; there are numerous species of arachnida which are known as pests of cultivated plants and as parasites on cattle and man. The plant pests include the well known mites often called as *red spiders*, *spider mites*, *gall mites* etc. In S. India we find different species attacking specially cereals, cotton, ganja, citrus and tea; these include the genera *Paratetranychus*, *Tetranychus* and *Eriophyes*. Parasitic arachnida include cattle, dog and poultry ticks (*Psoroptes*, *Argas*, *Rhipi-cephalus*, *Hyalomma*), and the skin mites affecting man (*Sarcoptes*, *Demodex*, *Peduculoides*, *Tyroglyphus* etc) causing complaints known as '*Acariasis*'. Spiders as a group are generally insectivorous and prove helpful in trapping various flying insects like moths, flies, mosquitoes etc. in their webs. Occasionally we come across spiders the webs of which are thick and cover some plants so badly that the growth of the latter is often checked.

We now come to the consideration of the group of *Insects* and their relations to man,—especially the farmer and stock breeder. Hardly any naturalist who knows anything of insects and their ways will doubt the fact that, in the keen struggle for existence going on incessantly in nature among the various animals living on the surface of the globe, no other animals have gained such remarkable success as the members of the insect world. This may be attributed among others to such important factors as their remarkable numerical strength, their peculiar life histories, their extraordinary powers of multiplication and their wonderful adaptations to put up a strong fight and survive the struggle for life. Among the various living beings inhabiting this world of ours, no other group of animals, except perhaps the fishes, can approach the insect community either in numerical strength or in the wealth and variety of species. The number of known living species of animals has been roughly estimated at about 900,000 and of this number over 60 % or about 625,000 are found to be insects. To give an idea of the comparative size of this group among the various divisions of the animal kingdom, we may take this illustration (slide shown). If we take the entire distance between the finger tips of our outstretched right and left arms across our chest to represent the size of the whole animal kingdom, then the size of all the other groups put together will not extend beyond the elbow of one arm from its finger tip, while the size of the insect group would occupy a distance stretching from the elbow of one arm across the chest and the two shoulders right up to the tip of the middle finger of the other arm. In size however, insects are comparatively small and this varies from one-seventy-fifth of an inch to six or seven

inches in length. The apparent defect in the size of insects, as compared with that of other animals, is more than made up by their remarkable numerical strength as has been shown above. As regards the distribution of insects, it may be stated that they are found all over the world; in land and water, on trees and shrubs, on other animals in households and under the soil. Knipe has described the position very nicely regarding the strength and distribution of these creatures in the following verses:—

> And what of insects, present everywhere,
> Through sea and land and flitting in the air?
> Why, half the matter charged with light on land
> These little creatures, countless, must command
> See how in orders, legions filled, they rise,
> Living alone, and in communities;
> From mites so small as scarce to meet the eye,
> To ant and bee, and gorgeous butterfly.

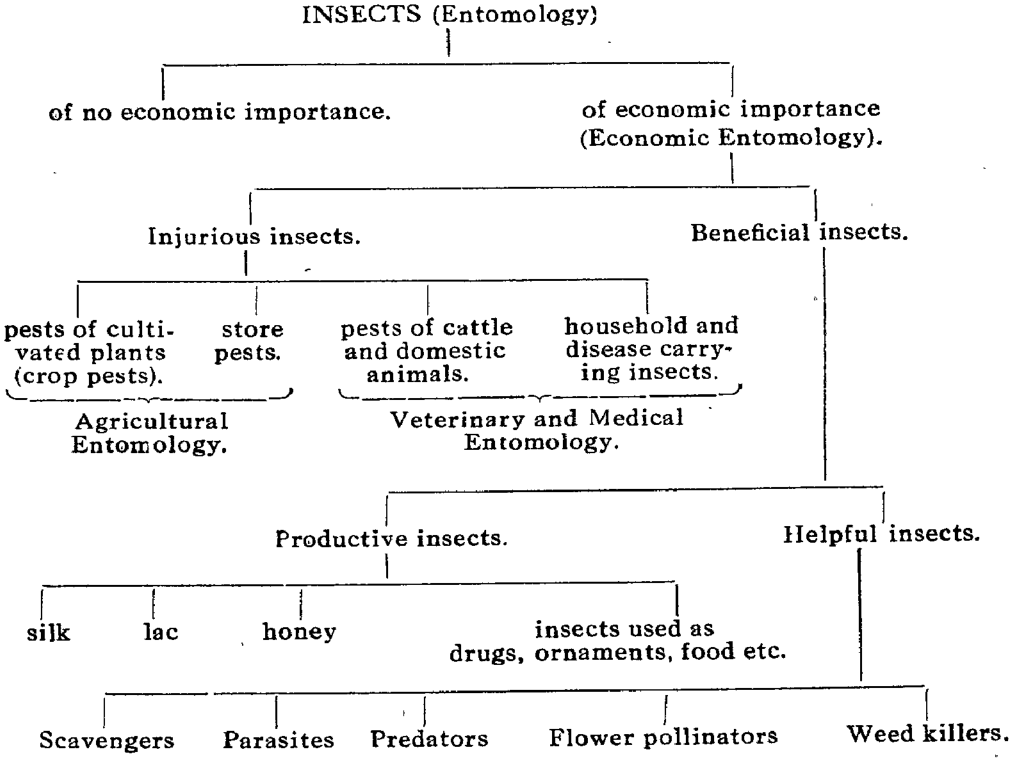
To give even a very vague idea of the remarkable adaptations possessed by insects to carry on successfully their vital activities will occupy pages of matter; so numerous, varied and extraordinary are these. Astonishing are the various adaptations for securing food, the structural provisions for offence and defence, the wonderful arrangements for communication between each other and the innumerable adjustments for sexual relations and propagation of the species. Such wonderful phenomena as parasitism and social life, the various adaptations in structure, mimicry, maternal instinct, and host of other features in their behaviour which Thompson aptly calls "*shifts for a living*" are factors very remarkable and often unique in the world of insects. One of the most remarkable phenomena in the whole animal kingdom is the peculiarity found in the life history of many insects. Unlike as in the higher animals and many other lower animals there is a phenomenon known as "*Metamorphosis*" among insects a series of striking and remarkable changes undergone by an insect as it passes from its childhood to its adult stage. The passage of a common butterfly from the tiny egg to the worm-like caterpillar or grub, into apparently lifeless objects the chrysalis or pupa, and the final transformation into the beautiful winged butterfly, all these striking changes, known together as Metamorphosis constitute a phenomenon which even many of our educated men are not aware of, though Shakespeare put it so nicely in the lines:

> "There is a differency between a grub and a butterfly.
> Yet your butterfly was a grub"

Most insects give rise to numerous offspring, which in their turn produce further generations in a very short period of time compared to higher animals and thus increase in numbers rapidly. These two advantages of greater fecundity and shorter life cycle play a very

important part in maintaining the remarkable numerical strength of many insects. According to Hodge "a pair of flies beginning operations in April, might be progenitors, if all were to live, of 191,010,000,000,000,000.000 flies by August, and allowing $\frac{1}{8}$ cubic inch to a fly, this number would cover the earth 47 feet deep". But, fortunately nature keeps up an even balance in the world without allowing any one creature to multiply extraordinarily and become a nuisance.

With these necessarily brief remarks on the general features of insects I would take you to the different aspects in which insects affect human interest and especially the agriculturalist. From the point of view of a layman and farmer, insects may be conveniently grouped as below under three main groups according to their behaviour towards man and his belongings.



From the above classification we find that under 'Economic Entomology' we can include Agricultural entomology, Veterinary and Medical entomology, apiculture, sericulture and lac culture. Agricultural entomology deals mainly with pests, their bionomics, and the methods which the farmer can adopt to check pests and utilise the help of other animals to control injurious insects. Now what is the part played by insects in relation to man and to our agriculture? The answer to this question is effectively supplied by the farmer in the fields, the kitchen gardener, and the provision dealer in stores and mills. For, these are the individuals who suffer from the depradations

of various insects which destroy a good portion of their produce from the fields and their stored stocks and thereby affect their finances. During certain years cultivated crops are entirely wiped out by hordes of locusts, caterpillars or bugs, and heavy loss is sustained by the farmers. Though in our country we have no clear ideas or statistics as to the extent of losses sustained in this way, the extent of loss caused by insects has been accurately assessed in the United States of America. According to Webster: "It costs the American farmer more to feed his insect foes than it does to educate his children; the estimated damage done by insects comes annually to 400 million dollars while the common schools and higher educational institutions cost together only 300 million dollars". According to Slingerland "The yearly losses from insect ravages in our country (the U. S. A,) aggregate nearly twice as much as it costs to maintain our army and navy, more than twice the loss by fire, twice the capital invested in manufacturing agricultural implements and nearly three times the estimated value of the products of all the fruit-orchards, vineyards and small fruit-farms in the country". Mr. Noel Paton, late Director of Commercial Intelligence, Calcutta estimated some years ago the annual loss in India caused to stored paddy and rice by the small rice weevil (*Calandra oryzae*) at 120 million rupees. Alarming reports appeared in the newspapers a couple of years ago of a destructive insect pest of stored paddy (*Rhizopertha dominica*) all over the southern districts and the Madras Agrcultural Department had to take serious notice of such an outbreak. Every householder is aware of the damage and loss caused to household materials by such insects as cockroaches, crickets, ants, silver fish, etc. Silks and woollens, carpets and upholstery are not spared by these vermin if left uncared for. Nor are cattle and other domestic animals free from the undesirable attentions of insects. Flies, fleas, lice etc. pester them and some of them often transmit diseases also among cattle, poultry, horses etc. These few facts bring out clearly the most important part played by insects in the economy of man. We shall however confine our attention mainly to the role of insects in Agriculture which constitutes the subject of Agricultural Entomology.

There is a general belief that insect pests—especially crop pests, appear more frequently nowadays than in the past years and many an old farmer has asserted to me that during the palmy early years of his life they had very few and only occasional outbreaks of pests to contend with. We have to admit the truth of this statement to a great extent; for, as civilisation advances and man begins to control nature in various ways, the "Balance of life in Nature", which keeps up a sort of balance among the various living beings in the world under ordinary conditions, is frequently upset and as a result we often hear of pest outbreaks.

A. Chief factors maintaining the Balance of Life are

1. Food 2. Climate 3. Enemies.

B. Chief factors interfering with the balance of life are:—

1. Growing of single crops in large areas.
2. The destruction of forests.
3. The destruction of insectivorous animals.
4. The frequent transport of animals and plants from place to place.

The four factors noted above are, as far as we know, the most important agencies frequently upsetting the natural balance and helping various organisms to multiply enormously and interfere with human interests. But in any case of pest outbreak it may often be very difficult to point out exactly which of these different agencies is responsible for the outbreak; for, in most cases it may be due to one of these factors or to a combination of one or more of them. The most important of the numerous stimuli which have contributed to the increased study of agricultural zoology in modern days have undoubtedly been the various attempts made by man at devising ways and means of controlling pests of different kinds. Having realised that these pest outbreaks noted frequently are chiefly the results of his own conscious or unconscious activities through decades, man has also been resorting to remedial measures to alleviate the loss sustained through insect pests.

I shall now give you some glimpses of the more important insect pests of our province by means of slides. Before doing so I may add a few general remarks regarding pests of cultivated plants as a whole.

There is hardly any cultivated plant which escapes the attentions of some insect or other though it may be found that some plants are more susceptible to their attacks than others. It is also found that among plant feeding insects, while a few of them depend for their food almost entirely on one plant (*Monophagous*), there are many others which are not so fastidious as regards their food and are found feeding on more than one food plant (*Polyphagous*). As to the nature of the damage caused to plants it will also be found that no part of a plant is free from insect attack and that every portion of it has its peculiar insect associates; the roots, stem, bark, shoots, leaves, flowers and fruits have all their characteristic insect pests. Nor is it rare to find insects of sorts visiting or temporarily remaining on plants either as mere visitors or as minor pests. Under these circumstances, it will be very advantageous if every cultivator gets to know in the first place which insects are his enemies and which are not; and of the former he might note those which constitute the major or important pests and those which are of minor importance. These are essential pre-requisites before one attempts to devise the possible control measures suited to each as necessity arises. By gradual experience, in observing and noting the different forms of damage caused to his crops by diverse insects the farmer will be in a position to more or less make out correctly

even from the external indications of the damage done, which the particular kind of pest is. Nor will he find it difficult in course of time to foresee as to the season or seasons when he might expect particular pests of different crops. In this way, experienced farmers of each different tract will be in a position to prepare what may be called insect pest calendars suited to the area and thus be not only well prepared to meet insect pests when they appear, but even be fit to prevent their appearance by methods adopted sufficiently early. In the same way, cultivators of special crops also come to know by experience as to the particular stage or stages in the growth of his crop when they can expect a particular kind of pest.

Apart from the specific pests of each particular crop there are a few categories of insects which infest many plants and cause the same kind of damage. These include, plant lice (*Aphidae*), scales, and mealybugs (*Coccidae*), locusts and grasshoppers (*Acridiidae*) leaf caterpillars of sorts, borers of different kinds (including beetles, caterpillars and flies), surface insects and underground insects of different kinds. I shall now explain to you some of the slides illustrating the more important of the general features of insects as briefly touched upon by me at the beginning, and some of the more injurious insect pests of agricultural importance found in our province, with the nature and extent of damage.

Within the past thirty years a good deal of spade work has been done in S. India in the matter of recognising our important insect pests and gathering preliminary data regarding their life histories, habits, and their relation to different crops, as may be seen from the numerous published papers on the subject. The real work however, of relieving the farmer and the cattle breeder from the losses caused by insect pests has only just started. This work which can only be carried out after much pioneering studies, is of a very important nature and is sure to tax the knowledge, ingenuity and resources of agricultural entomologists. For in the words of Curtis "The first step towards vanquishing the enemy is to ascertain correctly its habits, the next to be certain of its appearance, as not to mistake one party for the other and a third and no less important object is to be well acquainted with our friends and allies". Unless one gets some correct and definite ideas as to the real nature of the damage done, the remedies we may suggest may often prove worse than the diseases themselves. The utilisation of such knowledge and the devising of control methods should not merely be of an empirical nature; for Entomology is something more than squirting or dusting aresenicals or emulsions on the tails of insects—this is scarcely Entomology at all any more than horse shoeing is animal husbandry. The success of the Agricultural Entomologist depends a good deal on his proper up-to-date knowledge of the subject and sufficient practical experience

in the applied aspect of it. Some of the possible measures of pest control may be brought under the following heads.

1. *Preventive or Prophylactic methods (Indirect)*
   a) Field and plant sanitation
   b) Proper cultural methods (proper tilth, good seeds and manure and sufficient irrigation)
   c) Precautions against pest infestations.
2. *Curative or Direct methods.*
   a) Mechanical—collection by nets, bags, sticky boards, tray, traps, lights, catch crops etc.
   b) Chemical—Use of insecticides (dusting or spraying), fumigation, poison baiting, use of larvicides, repellants etc.
   c) Biological—Protection of natural enemies, such as insectivorous animals, parasites, predators; artificial propagation and utilisation of such natural enemies—the culture and use of fungus and bacterial diseases of insects.
   d) Legislative measures—Institution of quarantine laws, pest Acts etc. by Government in relation to important local and exotic pests.

Though it is not possible in this connection to give any details of all these different methods, a few words may be added regarding what is known as the Biological method of pest control—a method which has come to some importance within the past two or three decades. This process of insect pest control, to put it briefly consists in utilising the natural enemies of a pest to check the multiplication and serious effect of the latter. Such a process is going on in nature, as I mentioned above, in keeping up the balance of life, but when nature is helped by artificial methods in that direction we call it the Biological method of pest control. The adoption of this method on an artificial scale involves a thorough knowledge of the natural enemies of any crop pest and their bionomics. The important natural enemies of most of our insect pests are insectivorous birds, reptiles, toads, and insects themselves; and in many cases the enemies of different pests vary in number and in their relative efficiency as natural control agents. It has been found that insect enemies of insect pests such as predatory and parasitic forms render a great deal of good service in pest control. The group of lady bird beetles (*Coccinellidae*), and some groups of wasps (*Parasitic wasps*) and flies (chiefly *Tachinidae*) are insects which are highly beneficial to the farmer. As stated above the particular parasites and predators of different pests which vary in kind and controlling efficiency have to be studied thoroughly before resorting to this novel method of utilising the natural enemies of pests, for very often one comes across what is called a complex of natural enemies in relation to a single pest; sometimes a natural enemy such as a predator or a

parasite, is found to have its own natural enemy and, the latter in turn another as the doggerel runs.

> " Those fleas that do us bite
> Have other fleas that bite them
> And those in turn have other fleas
> And so *ad infinitum* "

Under the circumstances though biological control when feasible, is the most economic of all measures, the success or otherwise of each case will depend a good deal on the nature of the natural enemies, their number, their inter-relations and their efficiency in keeping the pest under check. In any case this method will have to be supplemented by other pest control measures indicated above; in this connection I might draw your attention to one or two weed pests where biological control has shown very remarkable promise of success. The most familiar example is the wonderful work of the *Cochineal* insect in eradicating prickly pear, one of our worst weeds, and another is the Lantana bug *Orthezia*, which, though not so marvellous in effect as the Cochineal, is capable of checking the wild spread of the lantana weed in some of our hill districts.

It will be unfair to the group of insects if, before finishing this theme, I do not at least make a passing reference to the brighter side of insect activities and show that, after all, we cannot condemn all insects as a whole and that there are insects which are extremely useful to man in several ways such as silk, lac and honey producers, flower pollinators, others that yield drugs, etc , and some others which are even used by man as food.

Gentlemen, I have tried in my own way to give you some ideas of Agricultural Entomology with special reference to South India and it is evident from all I have said and shown so far, how very important a subject Economic Zoology is. Professor Wilson of the U. S. A. Biological Survey has beautifully summarised the value of Economic Zoology in its relation to human affairs in the following words:—" In its relation to public welfare Economic zoology is of the most vital and far reaching importance. Animal life from its lowest organisms, among which lurk some of our deadliest foes as well as beneficent friends to the highest vertebrates, touches and affects our lives and welfare in innumerable ways. It must be studied in all its phases as never before to guard against previously unsuspected or little known diseases of man and domestic animals as well as to develop the wealth and ever increasing variety of products from which we obtain food, medicines, clothing, dyes, ornaments and an endless number of useful articles. No man can be considered well informed who has not a considerable knowledge of economic zoology in its more direct relationship to human life, while to the scientific investigator the subject has the charm of endless variety and service to mankind."

Though as I said once before a considerable amount of valuable spade work has been done in the field of Agricultural Entomology till now, a good deal remains yet to be done in the shape of bringing the fruits of the knowledge gained in that line and contributing its own share to the material prosperity of the country. In my opinion, apart from continuing the studies on the lines hitherto followed, viz., the recognition, collection, identification and life history studies and the usual treatment of pests, it is highly desirable that intensive studies and investigations should be pursued on the ecology of insect pests; in the words of Elton: "Animal ecology is a branch of zoology which is perhaps more able to offer immediate practical help to mankind than any of the others and in the present rather parlous state of civilization it would seem particularly important to include it in the training of young zoologists. It is the real foundation for applied Biology. The tropical entomologist, mycologist or weedkiller will only be fulfilling his functions properly if he is first and foremost an Ecologist". I would also emphasise the need for investigations in Agricultural Meteorology with special reference to the incidence of pests—a line of research which is full of promise in helping us to foretell the outbreak of pests and be on our guard. Nor need I emphasise the need for co-operation that is essential between the entomological worker, the plant breeder, the bio-chemist and the agriculturist in all the allied investigations and operations which have for their final aim the prosperity of agriculture in our country. I can only conclude this theme by repeating the following words of Professor Maskew in this connection—"The most important, the most vital thing in all the world is to get something to eat. If all of us here present, or mankind in general, were positively unable to obtain anything to eat for the space of one week, the affairs of this world—commercial or otherwise, would soon become of no more consequence than duckweed upon the surface of a pond. Without something to eat there would be no coal mined, no steel forged, no freight cars rolling. Agriculture in its broadest sense is the source of something to eat, and hence the original source of all subsequent action. Applied agriculture in practically all lands now recognizes that the greatest source of loss to cultivated crops can be traced to the depredations of insect pests and plant diseases".

I have finally to thank our president Mr. Broadfoot who has, besides honoring me by presiding over my lectures, helped me in every way with facilities for delivering my lectures at the Agricultural College, Coimbatore. I have also to thank Dr. Mulyil, Messrs G. V. Narayana, Suryanarayana and Naganatha Ayyar of the Institute for general help in making arrangements to project the lantern slides and diagrams during the lectures.

[*Note*:—The lecture was illustrated with numerous diagrams and lantern slides.]

ABSTRACTS

Coloured Insecticides for Aphids. *Scientific American 1937.* Mr. Moore concluded from his experiments that the aphids were attracted to the plants sprayed with bordeaux mixture because of increased intensity of light reflected from the sprayed surfaces. Spraying black coloured mixtures was found to be effective in reducing the infestation.

V. R.

Frost Resisting South American Potatoes. *Science* vol. 85. No. 2196. The All Union Institute of Plant Cultivation of U. S. S. R. was able to collect by sending a number of scientific research expeditions to South America, a large number cultivated and wild varieties of potatoes unknown to European countries, and a few of these new varieties were found to be resistant to *phytophthora*—the most dreaded disease of potatoes. One expedition was successful in spotting out a remarkable wild variety 'acaule' resisting frost of 17°F. The Institute has crossed these with local varieties and isolated from the progenies cultures breeding true to high yield and resistance to disease and cold. As a result, the problem of sowing the potato crop in the U. S. S. R. has now been considered as solved.

V. R.

EXTRACTS

The Phenomenon of Plant Growth. From a series of experiments Dr. Johnston of the Smithsonian Institution, and Dr. Burkholder of Connecticut College have studied the complementary roles of light and darkness on plant growth. According to them, nightly sleep or something very like it, is as necessary to plants as to animals. It was found that strong sunlight was destructive to the *auxins*, which are the growth-promoting substances in plants, while in an equal period of darkness, the growth-promoting power was greater. The inactivation of the auxins varied with the length and intensity of illumination, and the species of the plant. The phenomenon of growth is most rapid in darkness. It may be concluded that light is required for the synthesis of the auxins in the growing tip of the plant, but, once formed, they are most effective as growth's activator in darkness. *Science*, March 19, 1937.

Loans for purposes of irrigation work. The following are the conditions under which loans are given in Rhodesia by the Government for the construction of soil conservation works.

(a) Interest at the rate of 4½ per cent. per annum, and, if desired, the interest charges can be funded with the loan for the initial three year period during which no repayments are necessary, and the whole sum thereafter repaid in annual instalments up to a maximum period of 17 years.

(b) The loan to be secured by notice to the Registrar of Deeds for registration against the title deeds of the property concerned, or on the personal security of two sureties, who must be holders of immovable property in Southern Rhodesia.

(c) One-fifth on the loan can be paid out as soon as the applicant is ready to start the works, and the balance is paid on the certificate of an engineer of the Irrigation Division that the works have been satisfactorily completed and are valued at the amount covered by the loan.

In addition to the above financial provision an arrangement has been made with the Premier Portland Cement Company (Rhodesia), Limited, whereby

supplies of cement at reduced rates are available to farmers for use in water conservation works as under :—

1. Farmers who obtain a loan from Irrigation Loan Funds or from the Land Bank for the purpose of constructing water conservation works can obtain the cement required for the construction of these works on a Government requisition at a reduced price of 2s. 7d. nett per bag (94 lbs.) f. o. r. Cement Siding. The requisition for the supply of cement will be issued by the Irrigation Engineer responsible for the inspection and supervision of the works proposed. (*The Rhodesia Agricultural Journal Vol.* XXXIV No. 2 February 1937 Pages 85 and 86).

Gleanings.

Soil Erosion. Compiled by W. C. Lester-Smith, B.A., Dip. Rur. Econ. (Oxon), A. I. C. T. A. (Trinidad). *Tropical Agriculturist, Ceylon*, Vol. 88, No. 2.

Soil erosion is a process which goes on in all places at all times and at rates which vary according to local conditions. * * * * The distribution of rain, its daily intensity and the frequency of short-period downpours of extreme severity, are of most importance. * * * * * It has been established from observations made in widely different parts of the world that practically all the rainfall of a day's heavy rain usually falls within 10, or even within 7, consecutive hours, while a disproportionately large fraction of that amount falls within 1, 2 or 4 hours.

The results of processes of soil erosion are of the kinds which may be referred to as internal and external.

The internal results are restricted to the land which is being eroded. The surface soil, which contains the greater part of the nutrient matter and the whole of the organic food of plants is bodily removed, and with it are lost, not only the actual salts which serve to nourish the plant, but also the micro-organisms which bring these salts into this condition is thus seriously reduced and its physical properties, such as water-retaining capacity, are altered by the destruction of its tilth.

The soil, depleted of its most valuable ingredients by erosion, ceases to be able to support the crops grown on it, with result that even the protection which these crops normally give is largely lost. Erosion now reaches its second stage. The remaining top soil is washed away bodily; from the channels formed by the water as it rushes down the slopes, subsoil is scoured away and gullies and ravines develop.

The external results of erosion are many; they take various forms and are of a serious nature. One result of the removal of a forest cover is interference with the flow of streams. Water is removed rapidly from unprotected land instead of being temporarily detained. The flow of streams arising in such land becomes irregular, being decreased during fair weather and becoming torrential during monsoon weather. Irrigation channels and rivers become choked by silt carried down from the eroded land, and irrigation works are often destroyed by the rush of water during heavy weather. Agricultural areas below the eroded land, such as paddy fields, may be ruined by the deposition of large quantities of sand silt.

The control of soil erosion. Soil erosion is caused primarily by the free movement of matter on the surface of the ground. * * * * * It is not generally realised that doubling the velocity of water increases its transporting power sixty-four times.

To reduce soil erosion to a minimum it is necessary to :—

1. Protect the soil from the direct erosive action of rain water falling on it.
2. Obtain the maximum absorption of the rain water where it falls.

3. Control the removal of the surplus rain water.
4. Arrange for the collection and replacement.

It should be the aim of all who undertake any work for the reduction and prevention of soil erosion, to put into practice all the measures necessary to effect the first three of the above to such a degree that the last measure becomes unnecessary.

Reducing the force with which rain falls upon the surface of the soil involves the establishment of something to cover and protect the soil from the beating action of rain water falling directly on to it. High and medium shade, in combination with ground cover crops effectively perform function (b); * * * * Ground covers, however perfect they may be, cannot entirely prevent the movement of water on surface of the soil under rainfall of high intensity; but they do effectively reduce the rate of flow of this water, and so where the absorptive capacity of the soil is high, give it time to sink in or be absorbed.

Ground covers must be regarded therefore, as of primary importance in the prevention of soil erosion since they perform three of the four functions necessary to reduce soil erosion to a minimum.

The establishment of a satisfactory ground, cover, as rapidly as is possible, must be regarded as an imperative necessity for the prevention of soil erosion. Almost all crops will permit of this, with exception of a limited number of short period or seasonal plants. In the case of seasonal or other crops in which it is essential that no weed growth be permitted, it should be remembered that the provision and maintenance of a satisfactory surface much of organic material which has not entirely lost its original plant structure, can to some extent take the place of ground cover.

The rate of movement of water over the surface of the soil irrespective of the presence of ground cover, will vary mainly in accordance with the degree of slope of the area concerned. * * * * In the past it was customary to lead the free water of the land in so-calle l drains by the easiest and quickest possible route, and no account was taken of the soil which went with it. * * * The Soil Erosion Committee considered that it was possible to control the movement of surface water and stop the downward movement of surface soil by the use of ground cover; drainage systems are to be regarded as a second line of defence against soil erosion. The first line of defence should be in front of the drains, and it should be efficient enough to render the drains unnecessary in all but the heaviest and most prolonged down-pours, or to ensure that the water which finds its way into the drains does not contain silt but is clear and colourless.

In recent years various modifications have taken place in existing drains; silt pits are perhaps the most common and the least efficient. Their effective capacity for the retention of water and the collection of silt is confined to the pits themselves. Once they are full of water they cease for practical purposes to exist; the water in the drain flows unhindered over them and with the exception of the very coarse particles carries away any silt with which it may be charged.

Cameron's lock and step system, advocated by Mr. E. O. Felsinger is a distinct improvement; in effect it results in the conversion of the drain into a series of silt pits separated by narrow walls. A quantity of water equal to the storage capacity of the basin thus formed, is held up in each section and soil which it carries has an opportunity to settle. It is calculated that this system will hold 2 inches of rain before the spills overflow.

A further improvement which is subject to the same limitations however, is the following. The drain is divided by bunds as in the lock and step system but the sections between the bunds are excavated so as to be horizontal.

On gentle slopes and with an evenly distributed rainfall, the system of bunded catch water pits advocated in Java may be sufficient to provide for the holding up of all the run-off water. Rows of pits are dug in contour lines across the slope (Fig, 3)

Other works which aim at preventing the downward movement of water and soil on slopes, and thus aid in controlling the removal of surplus water, are stone terracing, the construction of contour and individual platforms and contour trench systems.

Much excellent stone terracing has been done on tea and rubber estates and there is no doubt that it does arrest a large amount of downward movement of soil on slopes. The efficiency of terraces depends more upon their frequency than on the height of the stone work, which it is considered, should not be more than 18 inches in height. Occasionally, however, much harm is done by water spilling over the tops of terraces and it is therefore essential that stone terracing should be supplemented by measures designed to ensure maximum retention and absorption of water falling on the terraces.

Contour platforms are considered to be a progressive method of opening new clearings and this system has proved its undoubted benefits. The platform slopes backwards into the hill, the inner edge being at least a foot below the outer. Small buttresses are left at intervals along the back of the platforms so that undue lateral movement of water is prevented. Silt pits are usually dug at the back of the platform, and the platforms are planted with cover crops which form a complete cover except for a space around each tree which is kept clean. There are no drains and the whole of the water falling on the land is absorbed.

In the contour trench system evolved by Mr. Denham Till the size of the trenches is first calculated so that they shall be sufficient on any area to contain the run-off water from the probable maximum downpour thereon. A level trench of the required dimensions, usually 3 ft. by 3 ft.; is cut at the base of the hill. Assuming that rubber is to be planted in rows 24 feet apart, the next trench, also level and of the same dimensions, is cut 24 feet from the centre of the first one and so on up the hill. The surface soil removed from the trench is thrown to the upper side and the subsoil to the lower side. The subsoil is used to form a bund on the lower side of the trench and creeping or other cover crops are grown on the bund. The trench is not filled in until immediately before planting, when it is half filled with top soil. Any rain which has fallen between the time of trenching and that of planting will have replaced some of the original surface soil thrown above the trench, and this may be increased by scraping the top soil from the ground above the trench until the requisite depth of soil is obtained. If no cover crop is grown other than that on the bund, local erosion taking place between the trenchs will result in the formation of a series of contour terraces.

The measure of next importance is to ameliorate the soil so that it attains its maximum absorptive capacity. The more water that is absorbed by the soil the less there is to run down the hill carrying soil with it. On hill side or sloping land the possibility of water logging does not require consideration, and the aim should be to absorb the maximum amount of water on such slopes both for the prevention of erosion and for the benefit of the soil itself. The cultivation of the soil is thus a matter of importance as it affects absorption, percolation, and the retention of soil moisture. Deep cultivation is preferable to superficial scraping, but while deep forking has a value in aiding absorption it will not prevent soil erosion. The results of experiments have shown that plain envelop forking increases erosion. It is necessary, therefore, that forking should be

supplemented by protection of the surface of the soil and by green manuring. Green manuring, leads to the formation of humus which increases the water, retaining capacity of the soil, to the aggregation of soil particles by flocculation, and to the production of tilth.

The fertility value of the eroded and transported soil particles is considered to be sufficiently great to render their return to the area under cultivation extremely desirable. The accumulations in silt pits, contour trenches, drains, etc. render this easily possible after the water that was in them has been disseminated through percolation, absorption, etc.

The regular return of this soil to the cultivation area will enable these silt traps to be maintained in an effective condition. The location or silting of them in the necessary places will reduce the distance this eroded soil has to be transported back and thus save a considerable amount of labour and expenses.

Agricultural Jottings

BY THE DEPARTMENT OF AGRICULTURE, MADRAS

Coconut nurseries and the selection of seedlings. The importance of raising a nursery for many agricultural crops is well recognised. It is particularly important for the coconut.

Seed nuts should not be planted in the field direct, but a nursery should be raised. This would facilitate easy selection of desirable seedlings, proper watering, control over pests and would prove not only convenient but economical.

A suitable piece of land with good drainage and close to a water source should be selected for the nursery. Sandy soil at least a foot deep is to be preferred. Besides the good drainage facilities it affords, it keeps off white ant attack commonly reported in the coconut nurseries.

The best time to start a nursery is the end of May or beginning of June so as to take advantage of the south west monsoon rains. Also it should be remembered that the seednuts which are harvested during the summer months should not get too dry.

The nut with the husk intact is buried in the soil to a depth of three-fourths of its length or flush with the soil, with the stalk end upwards. From various experiments conducted by the Agricultural Department it appears that the best position for planting is the vertical one, in which the germination is the quickest. The spacing to be given in the nursery depends upon the age of the seedling required, i. e., the length of the period for which the seedlings will be retained in the nursery. For obtaining 9 to 12 months old seedlings the nuts may be planted one to one and a half feet apart. Manuring of any sort is not necessary. Germination will commence in about two months and will extend to the fifth or sixth month. Watering is very necessary when the rains fail and during the hot season. While in loamy soils watering twice a week will suffice, in sandy soils it should be done every alternate day. The seedlings should be examined periodically for beetle and white ant attack. If the sun is too hot and scorching, partial shading by way of thatch may be provided so as to avoid scorching of young leaves.

The seedlings will be ready for transplanting by the commencement of the following year's south west monsoon rains Where the soils are light and easily drained, planting may be done at the beginning of the monsoon. In heavy soils and in places where the rains are heavy it is desirable that the transplanting is

done at the close of the monsoon as otherwise, water collects in the pits and dislodges the seedlings, due to the persisting nut which easily floats on water. The usual practice is to transplant a year old seedlings. But in some parts of the Presidency three to four months old seedlings are transplanted in the north-east monsoon. This is undesirable for it is not possible to make a proper selection in very young seedlings.

The importance of proper seed selection in a perennial crop like the coconut is well known to all planters. But the selection should not stop with the seed alone. It should be done in the seedlings as well. The question is often asked whether it is possible to judge the bearing capacity of a coconut tree from the nature of the seedlings from which it is raised. This problem is obviously of utmost economic importance to the planter, for the coconut comes to bearing only in ten to twelve years after planting. Intensive studies carried out at the Agricultural Research Stations (Coconut) on the west coast have shown that certain characters of the seedlings are related to the future performance of the palm. Based on this knowledge, it is recommended that seedlings with characters mentioned below should be selected, as they would ensure early and high yield.

1. Early germination of seed.
2. Large number of leaves in the seedlings.
3. The leaflets in the seedlings are united together unlike in the older palms. The united leaflets begin to split or separate at varying ages of the seedling. The earlier the separation the better is the seedling.
4. Short and strong leaf-stalks and closely set leaflets.
5. Thick stem and
6. Large number of roots.

Sugarcane cultivation in Tanjore District. Paddy is the main crop of the Tanjore delta. Due to fall in prices, its cultivation at present is not so paying as it was some years ago. Even under the present conditions, it would not be replaced by other remunerative crops on a large scale due to various causes limiting their introduction and cultivation. However, with the fall in prices of paddy, extension of cane cultivation has become an economic necessity. Therefore wherever conditions permit, sugarcane cultivation has been advocated and introduced with success and the area under the improved varieties is extending year after year. About 33 per cent. of the total area under canes last year was under the varieties advocated by the Department.

Before the introduction of the departmental strains there were two main varieties viz., 'Rasthali' and 'Nanal' under cultivation in principal sugarcane growing regions of the district. Thick exotic canes were introduced to replace Rasthali, while medium canes of the Imperial Cane-breeding Station, Coimbatore have been advocated in Nanal tracts. The spread of the thick canes has been far below expectation due to the fact that they are not only of longer duration but also require plenty of moisture and manuring and do not withstand water logging conditions. The spread of the Coimbatore medium canes, Co. 281 and 285 has been more rapid and the ryots have taken to their cultivation more enthusiastically and these varieties do not suffer the disadvantages of thick canes. These are of short duration requiring less cultivation expenses and capable of withstanding drought and water logging conditions. With Co. 281 good jaggery is obtained in 8 to 9 months amounting to about 6000 lb. per acre on an average and it ratoons satisfactorily. This variety is replacing the exotic canes and also the local Rasthali in places where it is not grown for chewing purposes.

The other improvements in cane cultivation such as planting in trenches to prevent lodging as far as possible, manuring the crop economically and better preparation of good jaggery have been introduced. About 33 per cent. of the

total area was under trench planting in the last season. Iron mills have been demonstrated and introduced for better extraction and Scindvahi furnaces have been constructed to save fuel; for better germination, short cropping is being advocated. Many ryots prefer to sell their canes to the factory. This saves them the trouble of milling but the net gain obtained is almost similar to their milling and disposal of the produce as jaggery.

Green manuring and application of phosphatic manures to paddy crop in Tanjore District. It is well known that organic manures are necessary for increasing the yield of paddy; of these, those readily available in the country are cattle manure and green leaves. The former is not sufficient to manure even the one-twenty-fifth of the area, and the latter is not available in any large quantity due to lack of large forest areas in the district. Therefore the Agricultural Department has been advocating the growing of green manure crops in paddy lands. Although the system of growing green manure crops is spreading, it has not as yet become a general practice throughout the delta. Due to high prices obtained for paddy in pre-depression days, much heed was not paid on manurial side. But with the reduction in prices with little hope of recovery in the near future, Tanjore mirasdars, as their fellow cultivators in other districts, are faced with the situation to increase the outturn, so that, what is lost in prices may be made up to some extent by enhanced yield. Towards this situation, the cheapest way of manuring i. e. raising of green manure crops in paddy fields and applying the same with phosphatic manures like bone-meal, has been advocated as in the past and the response received to this propaganda work has been fairly satisfactory. In various parts of the district, demonstration plots were laid out in the last season and the yields obtained in almost all the cases not only paid the cost of manuring but also left a fair margin of profit amounting to about Rs. 2 per acre on an average while in some individual cases it amounted to as much as Rs. 7 to 8.

The present area under green manure crops is about 32, 917 acres and during the last season 2, 30, 918 lbs. of green manure seeds were distributed by the combined efforts of the department and other agencies such as Co-operative Societies and Agricultural Associations. The persistent propaganda to prevent cattle trespass in case of raising Daincha and Indigo is having its effect and successful crops are now being raised on lands where Kolinji does not fare well or fails. The economic depression, which is compelling the mirasdars to increase the cultivation by cheap manuring, acts as a factor to guard against the cattle trespass and raise other kinds of green manure crops for which a response has been made.

College News and Notes.

The college reopened on the 15th June 1937 after the summer holidays for the students of B. Sc. Ag., classes II and III.

Weather Review (APRIL 1937).

The unsettled conditions in the Bay of Bengal have developed into a depression which later moved rapidly and centred close to the coast between Madras and Nellore. There has been nearly general rain associated with thunderstorms in south east Madras, Malabar, and local rains on the Madras coast, with a few falls in the Madras, Deccan, Mysore, Lower Burma and the Punjab hills.

The weather during the month was characterised by thunder showers and local rains in the Peninsula. Rainfall was above normal throughout the Peninsula.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st	Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	1·2	+0·50	9·4	South	Negapatam	1·3	+0·7	8·9
	Calingapatam	1·9	+1·1	5·5		Aduthurai *	1·6	+0·7	3·1
	Vizagapatam	2·2	+1·5	5·3		Madura	1·0	-1·1	1·5
	Anakapalli *	5·7	+4·5	11·36		Pamban	3·5	+1·9	10·2
	Samalkota*	6·9	+6·3	8·5		Koilpatti *	3·6	+0·6	6·3
	Maruteru *	2·2	+1·7	3·1		*Palamkottah*	2·4	-0·1	6·3
	Cocanada	5·3	+4·7	6·1					
	Masulipatam	2·7	+2·1	5·3					
	Guntur*	2·6	+0·5	3·1	West	Trivandrum	8·5	+4·0	13·8
					Coast	Cochin	8·8	+4·1	11·1
Ceded	Kurnool	3·3	+2·7	4·4		Calicut	5·7	+2·5	5·9
Dists.	Nandyal*	5·6	+5·2	7·1		Pattambi *	3·5	+0·4	4·1
	Hagari *	2·7	+2·0	3·7		Taliparamba *	0.0	0·0	0 0
	Bellary	3·3	+2·6	5·1		Kasargode *	7·0	+4 3	7·0
	Anantapur	3·9	+3·4	4·6		Nileshwar*	4·2	+2·5	4·4
	Rentachintala	4·1	...	5·9		Mangalore	4·5	+3·2	4·5
	Anantharaju-pet *	4 2	+3·3	4·2					
					Mysore	Chitaldrug	0·9	0·0	1·1
Carnatic	Nellore	2·3	+2·0	29·8	and	Bangalore	6·4	+5·1	9·0
	Madras	2·6	+2·1	2·7	Coorg	Mysore	4·3	+2·0	5·9
	Palur*	0·5	+3·6	4·1		Mercara	4·6	+2·0	9·4
	Tindivanam *	0·5	0·0	2·7					
	Cuddalore	0·5	-0·1	3·7					
					Hills.	Kodaikanal	7·2	+2·9	11·9
Central	Vellore	3·7	+2·7	4·4		Coonoor*	8·1	...	22·0
	Salem	2·4	+0·6	2·4		Ootacamund *	10·2	+6·6	13·5
	Coimbatore	3 2	+1·8	4·1		Nanjanad *	5·7	+2·4	10·0
	Coimbatore A. C. & R. I.*	3·7	+1·5	5·9					
	Trichinopoly	7·9	+6·2	8·6					

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 (published in Fort St. George Gazette).

Weather Report for Research Institute observatory.

Report No. 3/37.

Absolute Maximum.	...	98·2°F.
Absolute minimum.	...	71·0"
Mean maximum.	...	93·5"
Departure from normal.	...	-2·4
Mean minimum.	...	73 0
Departure from normal.	...	+0·1
Total rainfall.	...	3·73"
Heaviest rainfall.	...	1·27 (recorded on 17th)
Number of rainy days.	...	6
Mean daily wind velocity.	...	1·3
Mean humidity.	...	71·5
Departure from normal.	...	0·7

Summary. The mean maximum was below normal by 2·4°F while the mean minimum and humidity was about the normal. The rainfall was in excess by 1·53". During the month dry weather prevailed in the first two weeks while in the third and fourth week fairly humid conditions existed.

P. V. R. & P. G.

Departmental Notifications.

1. Promotions.

1. M. R. Ry. K. Govindan Nambiar, A. D., II grade provisionally substantive to be substantive from 23--2—37.

2. M. R. Ry. K. M. Jacob, A. D., III grade provisionally substantive to be substantive from 23—2—37.

3. M. R. Ry. T. V. Krishnaswami Rao, A. D., IV grade provisionally substantive to be substantive from 28—9—36.

4. M.R.Ry. G. Sitaram Sastri, A.D., IV grade provisionally substantive to be substantive from 23—2—37.

5. M.R.Ry. T. G. Anantarama Ayyar, F,M., L.R.S. Hosur, from III grade to II grade with effect from 23—2-37.

6. M.R.Ry. D. Panakala Rao, A.D., II Circle, from IV grade to III grade with effect from 23—2-37.

7. M.R.Ry. V. K. Kunhunni Nambiar, F.M., A.R.S., Pattambi from Vth grade to IVth grade with effect from 23—2—37.

8. M.R.Ry. K. Balaji Rao, A.A.D. Hospet, from III grade to II grade to take effect from 16—9—36.

9. M.R.Ry. K. Achyutan Nambiar, A. A. D., Mycology, from IV grade to III grade, to take effect from 16—9—37.

10. M.R.Ry. T. A. Rangaswami Ayyangar, A. A. D., Nanilam, from IV grade to III grade, to take effect from 1st January 1937.

11. M.R.Ry. P. V. Hanmantha Rao., A. A. D., Palladam, from V grade to IV grade, to take effect from 16-9—36.

12. M.R.Ry. C. V. Sankaranarayana Iyer, Sub Assistant Paddy Section, Coimbatore, from V grade to IV grade, to take effect from 16—9 36.

13. M.R.Ry. B. Venkataraman, A. A. D., Yellamanchili, from V grade to IV grade, to take effect from 16—9—36.

14. M.R.Ry. T. V. Ayyaswami Ayyar, A. A. D., Tirupathur, from V grade to IV grade, to take effect from 1st January 1937.

2. Transfers.

Name of officers.	Transferred	
	From	To
Mr. P. V. Samu Ayyar	A. A. D. Kulitalai.	Fourth Circle.
„ C. A. S. Ramalingam Pillai	A. A. D. Fourth Circle	A. A. D. Ariyalur.
„ S. Mahadeva Ayyar	A. D. Ariyalur	A. D. Trichinopoly.
„ S. V. Doraiswami Iyer	A. L. A. Coimbatore	F. M. Guntur.
„ M. Alagiriswami	A. F. M. Coimbatore	A. D. Fourth Circle.
„ E. Kunhappa Nambiar	A. L. A, Coimbatore	F. M. Taliparamba.
„ K. Ramaswami Iyer	A. D. Sixth Circle	A. L. A. Coimbatore.
„ K. Sanjeeva Shetty	F. M. Nileshwar	A. L. A. Coimbatore.
„ P. A. Narayanan Nambiar	A. D. Cannanore	F. M. Nileshwar.
„ R. Guruswami Naidu	L. R. S. Hosur	A. R. S. Guntur.
„ A. Shanmugasundaram	L. R. S. Hosur	A. R. S. Aduturai.
„ Azimuddin	F. M. Aduturai	L. R. S. Hosur.
„ A. Gopalan Nair	F. M. Taliparamba	A. D. Tellicherry.
„ K. Govindan Nambiar	A. D. Tellicherry	A. D. Cannanore.
„ T. K. Thangavelu	A D. Coonoor	A. D. Ootacamund.

Mr. B. Dasappa Malli	—	A. D. Coonoor.
„ K. G. S. Bhandary	A. D. Ootacamund	A. D. Tirupur.
„ S. Kanakaraj David	Asst. Paddy Section	Chemistry Section.
„ K. Veerabhadra Rao	Asst. Chemistry Section	First Circle.
„ S. Sundaram	Asst. Madras Fodder Cholam Scheme	Asst. Cotton Section, Coimbatore.
„ A. Ramadoss	Asst. Cotton Section	Asst. Pempheres and Physiological Scheme.
„ S. Anantam	Asst. Pempheres and Physiological Scheme	A. D. Saidapet.
„ M. R. Balakrishna Iyer	Asst. Madras Fodder Cholam Scheme	Asst. Chemistry Section.
„ S. Ramachandra Rao	Leave	Asst. Paddy Station, Buchireddipalayam.
„ N. Annaswami Ayyar	A. D. Chittoor	A. D. Tirupattur, VI Circle.
„ M. C. Krishnaswami Sarma	A. A. D. Tirupattur	A. A. D. Dindigul.
„ A. Chidambaram Pillai	A. D. Dindigul	A. D. Madura.

3. Leave.

Name of officers.	Period on leave.
Mr. T. Varahalu, Asst. Chemistry Section	Extension of l. a. p. for one month from 4th June 1937.
„ N. Subramania Iyer A. D., Trichinopoly	2 months l. a. p. from the date of relief.
„ T. G. Anantarama Iyer, L. R. S. Hosur	l. a. p. for one month and 13 days from 17—5—37.
„ T. R. Naganatha Iyer, Sub Asst in Botany	l. a. p. for 2 months from 30—5—37.
„ V. M. Ramunni Kidavu, A. D., Perintalmanna	3 months on m. c. from 27—4—37.
„ M. Subramania Pillai, A. D.	Extension of l. a. p. for 1 month on m. c. from 1--6—37.
„ V. Achyutharamaiah, A. D.	l. a. p. for 2 months and 15 days from 5—5—37.
„ M. P. Narasimha Rao, Asst. A. R. S. Maruteru	2 months on m. c. from 3—5—37.
„ R. Venkatarama Iyer, A. D. Vridhachalam	l. a. p for 2 months from 23—5—37
„ P. Parthasarathy, F. M., Kodur	Extraordinary leave for 4 weeks from 2--6—37.
„ C. S. Sankaranarayana Iyer, F. M., Nanjanad.	l. a. p. on m. c. for 2 months from 14—5—37, and 11 days from 3—5—37 without m. c.
„ G. Sakharam Rao, A. D., Udipi	1 month on m. c. from 13—6—37.
„ S. Veeravarada Raju, A. D., Avanashi.	Extension of l. a. p. for one month from 1—6—37.

UNIVERSITY OF MADRAS.

B. Sc. Degree Examination in Agriculture, 1937

FIRST EXAMINATION

1. AGRICULTURE

Monday, 5th April. 7 A. M. to 10 A. M.

Maximum: 60 marks.

Answer six *questions. Questions 2 and 6 are compulsory.*

1. Describe a rain-gauge. State what precautions you would take in locating a rain-gauge. What is meant by the term 'an inch of rainfall'? (9 marks.)

*2. (*a*) Explain the cause of the Indian monsoons, and show how they are influenced by the pressure distribution and rainfall in other parts of the world.

(*b*) State how the croppings of the agricultural tracts of India are regulated by the monsoon rains. (12 marks.)

3. Give an approximate idea of the range of temperature and humidity in Coimbatore and its neighbourhood during the different seasons of the year. Explain in a general way how the variations occur. (9 marks.)

4. How are soils formed? What are the special characteristics of the Indian black cotton soil? Draw a sketch of its distribution in South India. (9 marks.)

5. Examine in a general way the nature of the soil profiles presented by a cutting into the soil, say, to a depth of 30 feet in a place in the upper reaches of the Tanjore Delta and in the Agricultural College Farm, Coimbatore, and discuss how the differences, if any, are brought about. (9 marks.)

*6. Define 'tilth'. What steps would you take progressively to prepare the land to a fine tilth? What time, labour, and cost would it entail to make a five-acre piece of black soil fit for sowing? (12 marks.)

7. Describe a 'disc plough' and show how and when it can be worked. Compare the land broken with the disc plough with that worked with a mould board plough. (9 marks.)

8. Write short notes on:—clouds, sub-tropical belt, trade winds, laterite, felspar, sand-dune, buck scraper, bed former, reversible disc plough. (9 marks.)

2. BOTANY

Tuesday, 6th April. 7 A. M. to 10 A. M.

Maximum: 60 marks

Answer six *questions*, three *in* A *and* three *in* B. Questions 3 and 5 compulsory.

The answers to questions in A *and* B *must be written in* separate *answer-books.*

A

1. Name six different plants whose underground parts are of economic value. Give a sketch of the subterranean portion in each case, and discuss its morphology. (9 marks.)

2. The vascular system is continuous from root to stem. Show, with sketches, how transition is effected from the root to the stem structure. (9 marks.)

*3. Classify the following plants into their families, and mention the distinguishing characters of those families, with floral diagrams:—*Hevea brasiliensis*, *Ricinus communis*, *Triticum vulgare*, *Phyllanthus emblica*, *Pennisetum typhoideum*, and *Saccharum spontaneum*. (12 marks)

4. What is the advantage of the dispersal of seed and fruit to the species? Enumerate some typical instances of dispersal of seeds and fruits and the adaptations which fit them for such dispersal. (9 marks.)

B

*5. Describe an experiment to show that respiration takes place in plants. What is respiratory quotient, and what are the factors influencing it ? (12 marks.)

6. Give instances of leaves which show movements. What is the significance of these movements ? (9 marks.)

7 Describe in detail the process of meiosis in plants, and discuss its significance. (9 marks.)

8. Write short notes on :—plastids, parenchyma, bordered pit, laticiferous tissue, chemotropism, primordial utricle. (9 marks.)

3. CHEMISTRY

Wednesday, 7th April. 7 A. M. to 10 A. M.

Maximum : 60 marks.

Answer six *questions,* three *in* A *and* three *in* B. *Questions* 4 *and* 5 *are compulsory. The answers to questions in* A *and* B *must be written in* separate *answer-books.*

A

1. How would you establish the presence of the following groups in an organic compound :— CH_2OH ; NH_2 ; CN ; CHO ? (9 marks.)

2. Explain clearly what is meant by primary, secondary, and tertiary alcohols, giving examples. Describe *two* methods by which you would distinguish them. (9 marks.)

3. Write notes on the following, illustrating your answer by selecting suitable examples :—homologous series, aldol condensation, isomerism, and optical activity. (9 marks.)

*4. Describe the preparation of urea. What are its chief chemical properties ? How would you prove that it is the diamide of carbonic acid ? (12 marks.)

B

*5. How are the two hexose sugars united in the molecules of (*a*) sucrose, (*b*) maltose ? Describe a simple experiment to illustrate the difference. Explain why, while both the sugars are optically active, maltose reduces copper solutions but sucrose does not. (12 marks.)

6. What experiments would you perform to establish that glucose is an aldehyde while laevulose is a ketone ? (9 marks.)

7. Mention the general groups of substances that form the ultimate units of the protein molecule. Give the methods of their preparation and their more important properties. (9 marks.)

8. Starting from benzene, how would you prepare the following substances:- phenol, benzaldehyde, and benzoin ? (9 marks.)

4. ZOOLOGY

Thursday, 8th April. 7 A.M. to 10 A.M.

Maximum: 60 marks

Answer six *questions. Questions* 1 and 3 *are compulsory.*

*1. Write an essay on *either* 'The Influence of the Environment on the Organism', *or* 'Inherited Adaptations in the Animal Kingdom'. (12 marks.)

2. 'Hydra is probably a degenerate type of the class Hydrozoa and is therefore hardly representative of that class.' Examine the validity of this statement. (9 marks.)

*3. Describe, with the aid of diagrams, the essential features in the morphology and internal organization of any annelid that you have studied, and point out those advanced characters which clearly separate it from a coelenterate or a nematode. (12 marks.)

4. Explain, with the aid of examples, the following terms :— parapodia, metamerism, triploblastic, vestigial structures, commensalism, hermaphrodite, and binomial nomenclature. (9 marks.)

5. What are fossils? How are they formed? What is their biological importance? (9 marks.)

6. Describe briefly how the following animals feed:— amoeba, sea-urchin, earthworm, house-fly, grasshopper, prawn. (9 marks.)

7. What is the nature of the evidence available at present to show that birds are descended from reptilian ancestors? (9 marks.)

8. Write brief notes on :-- cytoplasmic inclusions, notochord, vomerine teeth, edentates, marsupials, cysticercus, Aristotle's lantern. (9 marks.)

SECOND EXAMINATION

1. AGRICULTURE. PLANT HUSBANDRY. I

Monday, 5th April. 7 A. M. to 10 A. M.

Maximum: 100 marks.

Answer six *questions.* Questions 1 and 3 *are compulsory.*

*1. Under what category of manures would you classify the 'farm-yard manure'? Give reasons. Describe the best method of preparing farm-yard manure. Would you recommend this method for general adoption in all circumstances? If not, what alternative would you suggest? (18 marks.)

2. Explain what you understand by the terms 'green manuring', 'green leaf manuring', and 'green soiling'. Discuss how these three methods could be fitted into the normal agricultural practices of the Province of Madras. (16 marks.)

*3. Lay out a scheme of five-course rotation for a typical garden land area (loam) in Coimbatore, introducing a fallow, green or bare, and mentioning the advantages or otherwise of so doing. Discuss the effects of each crop in the rotation on the soil and on the succeeding crop. (18 marks.)

4. How would you effectively eradicate Hariali grass from a black soil area? What different methods would you have recourse to, taking into consideration cost, availability of labour, and local practice? (16 marks.)

5. What is 'pati mannu'? How has it originated? What use is made of it agriculturally? Are you aware of large applications of this material to any crop or crops? What effective substitutes would you recommend in places where this supply has run short? (16 marks.)

6. What are the various methods followed to prevent the ill-effects of erosion in cultivated lands? Mention one such method which you recommend for adoption in black soil fields. (16 marks.)

7. Describe the various methods that obtain among the farmers of this country for reclaiming alkaline lands. What is the role that sub-soil drainage plays in this reclamation? What are its limitations? (16 marks.)

8. Write brief notes on :—fire fanging, poudrette, leaf mould, red soils, partial sterilization of soil, rab-burning, activated sludge, guano. (16 marks.)

2. AGRICULTURE. PLANT HUSBANDRY. II

Tuesday, 6th April. 7 A. M. to 10 A. M.

Maximum: 100 marks.

Answer six *questions.* Questions 3 and 8 are compulsory.

1. Describe the improved pattern of the South Arcot circular mhote. Compare its efficiency with that of the old model and of the ordinary picottah. (16 marks.)

2. (*a*) What do you understand by (i) percolation wells, (ii) spring wells, and (iii) artesian wells? Under what conditions and in what parts of the Presidency of Madras do you find such classes of wells in large numbers? How is the water table affected in each such class of wells in different seasons?

(*b*) Distinguish between sinking a well and digging a well. When is the former method resorted to, and why? (16 marks.)

*3. Define duty of water. What duty would you fix for the following crops:—summer cholam, fodder sorghum, sugar-cane, tobacco, and cambodia, granting that you have a flow of water through a 12-inch vent with a velocity of 2 feet per second? Is this duty variable? If so, under what conditions? (18 marks.)

4. Describe the various improvements in the cultivation of sugar-cane and preparation of jaggery. (16 marks.)

5. Discuss the rationale of dryland cropping in the circars, with paddy as main crop, on the same land year after year. (16 marks.)

6. In Kistna and Guntur it is invariably the rule to thresh paddy long after it is harvested. Discuss the economics of this practice in all its bearings. (16 marks.)

7. Give the variations in seed rate for the following crops as grown in parts of the Madras Presidency, and explain the reason for such variations:—groundnut, bengal gram, cholam, cumbu. (16 marks.)

*8. Write a short account of the cultivation of any one of the following crops:—chillies, turmeric, plantains, ginger, and prepare a balance sheet. (18 marks.)

3. AGRICULTURAL ENGINEERING

Wednesday, 7th April. 7 A. M. to 10 A. M.

Maximum: 60 marks.

Answer six *questions.* Questions 3 and 6 are compulsory.

1. (*a*) Compare compass surveying with chain surveying from the points of view of accuracy, scope, applicability, and rapidity.

(*b*) When would you prefer to use a compass and when a plane table? Give your reasons. (9 marks.)

2. (*a*) What are the important varieties of timber available in India for engineering works, and what are their special qualities?

(*b*) Describe one of the best methods of artificial seasoning of timber.

*3. A warehouse 60 feet by 25 feet is to be provided with Mangalore tile roofing. The internal height of the wall is 20 feet. Timber trusses are placed 10 feet apart. Draw to a scale of 1 inch=3 feet a cross-section of the building, showing details of the truss, purlins, common rafters, wall plates, ridge piece, pole plates, and side walls with suitable foundations in a gravelly soil. Give dimensions of all the parts. (12 marks.)

4. Describe and give sketches of a pumping installation for a well 70 feet deep with a variation in water-level between 25 and 65 feet, yielding normally about 5,000 gallons of water per hour for 8 hours in a day. (The depths are measured from the surface.) (9 marks.)

5. (*a*) What are the various parts of an improved plough? What care has to be taken in the manufacture of such a plough to make it function efficiently?

(*b*) What are the types of such ploughs that you are familiar with, and under what conditions are they used? Include in your answer ploughs used for mechanical draught.

(*c*) What are the materials used in the construction of an improved plough? Describe their properties. (9 marks.)

*6. Describe the principle on which the internal combustion engine works. What are the differences between the indicator diagrams of a steam engine, a gas engine, and a Diesel engine? How do you account for the differences? Name the different kinds of internal combustion engines and their use for pump irrigation. (12 marks.)

7. What are the usual troubles encountered in a pumping installation consisting of a centrifugal pump and a kerosine engine, and how are they overcome? Give your answers under the heads engine and pump separately. (9 marks.)

4. AGRICULTURAL ZOOLOGY

Thursday, 8th April. 7 A. M. to 10 A. M.

Maximum: 60 marks.

Answer six *questions*. Questions 1 and 2 are compulsory.

*1. In the uninhabited forest or the untilled plain, there is such a harmony of interaction among organic groups that insect pests are of very rare occurrence; but in countries occupied by man there are few crops free from the ravages of insect pests. How do you account for this difference? (12 marks.)

*2. Describe with the aid of diagrams the structural differences observed in the mouth parts of insects, and point out how a knowledge of these differences helps (*a*) in the classification of insects, and (*b*) in the determination of control measures directed against injurious insects. (12 marks.)

3. What are the principles involved in the following entomological practices:—(*a*) fumigation of stored products; (*b*) the use of light traps; (*c*) mixing crude oil emulsion in irrigation water; (*d*) ringing of coco-nut palms with tin bands; (*e*) the application of a combined spray, and (*f*) the raising of trap-crops? (9 marks.)

4. What are predators? How do they differ in their habits from parasites? Mention some of the non-hymenopterous insect predators, stating in each case the Order and Family to which it belongs and its economic importance. (9 marks.)

5. Give an account of the more important insect enemies of domestic animals in South India under the following heads:—(*a*) the name and Family of the pest (*b*) the nature and extent of the injury caused, (*c*) the control measure or measures you would suggest. (9 marks.)

6. What is the agricultural importance of earthworms, eelworms, millipedes, the Russel's viper, the king-crow, and the flying fox? (9 marks.)

7. Write short notes on:—chaematropism; parthenogenesis; muscardine; book solution; royal jelly; scarabidae; filariasis. (9 marks.)

8. Write an essay on:—'Insect pests of vegetables and how to control them.' (9 marks.)

5. ANIMAL HYGIENE

Friday, 9th April. 7 A. M. to 10 A. M.

Maximum: 60 marks.

Answer six *questions*. Questions 1 and 4 are compulsory.

*1. Describe the mechanism of rumination in the ox with the aid of a diagram. (12 marks.)

2. Describe the patella joint. What would you do in the case of dislocation of the patella in the ox? (9 marks.)

3. What do you understand by the following, and how do you deal with each of them:—(*a*) sinus, (*b*) abscess, (*c*) impaction of rumen? (9 marks.)

*4. Describe the aetiology, symptoms, and course of contagious aphtha. What preventative measures would you adopt in an outbreak of the disease? (12 marks.)

5. Define the following terms and give two examples, with dose for cattle, of each of them:—(*a*) anthelmintics, (*b*) antispasmodic, (*c*) antiseptic, (*d*) carminative. (9 marks.)

6. Describe the causes, symptoms, and treatment of choking in bullocks. (9 marks.)

7. What are the causes of retention of placenta in the cow? How would you treat a case? (9 marks.)

8. Describe the symptoms of blackquarter in cattle. What causes it, and what measures would you adopt in preventing the spread of the outbreak? (9 marks.)

FINAL EXAMINATION

1. AGRICULTURE. ECONOMICS AND FARM MANAGEMENT

Wednesday, 14th April. 7 A. M. to 10 A. M.

Maximum: 100 marks.

Answer six *questions.* Questions 1 and 5 are compulsory.

*1. Equip a farm of 100 acres with human labour, cattle, and dead stock, to enable one to carry on mixed farming—growing crops (wet, garden, and dry) and fruits, producing milk for a colony of fifty middle-class families, and rearing poultry to give 100 eggs daily. Limit wet and garden crops and fruits to 10, 25, and 5 acres respectively. Draw a neat sketch showing the allotment of the various crops, farmstead, buildings, roads, drains, and wells. (18 marks.)

2. Explain what is meant by 'statistical significance' in field experiments. Lay out a scheme of experiments for comparing two selections of a grain crop with a local standard type, and indicate all the details you would attend to in installing the experiments and carrying them through. Show by a set of hypothetical figures how the results can be interpreted to be significant or otherwise. (16 marks.)

3. What are the agents of production? How is each factor to be remunerated for the part it plays in productive activities? (16 marks.)

4. What kind of live fence would you prefer to have for a farm? Give reasons for your choice. Estimate the cost of establishing such a live fence for a farm of 100 acres, the shape of the farm being rectangular, with length about twice the breadth. (16 marks.)

*5. Discuss briefly the law of supply and demand, and draw up a diagrammatic representation. State how far the marginal utility and marginal cost of production influence demand and supply. (18 marks.)

6. What problems confront the sugar manufacturer at the present time, and how is he to be helped in his solution, safeguarding at the same time the interests of the cane grower? (16 marks.)

7. What is meant by distributive co-operation? How far is the co-operative stores movement in this province representative of this phase of co-operation? It is said that co-operative stores have not been such a success in this country. Discuss the causes and propose remedies, if necessary even by suggesting modifications of the by-laws. (16 marks.)

8. Write explanatory notes on:—margin of cultivation; unearned increment; law of diminishing returns; vertical and horizontal combinations; bartering; elastic and inelastic demands. (16 marks.)

2. AGRICULTURE, ANIMAL HUSBANDRY AND DAIRYING

Thursday, 15th April. 7 A. M. to 10 A. M.

Maximum : 100 marks.

Answer six *questions.* Questions 1 and 5 are compulsory.

*1. Prepare a score card for the best type of a stud bull, indicating how you would award marks for (*a*) breed points, (*b*) utility points, (*c*) fancy points. State how these various features are to be evaluated in respect of the three breeds—Ongole, Kangayam, Mysore. (18 marks.)

2. What is a general purpose animal? How far would the maintenance of Scind stud bulls in parts of the country for the improvement of dairy cattle fulfil the purpose? Have you any other proposals to make? (16 marks.)

3. What practical steps would you take to provide a regular supply of fodder and pasturage for a small dairy herd of twenty-five cows for a year? Calculate the cost. How would you compute the quantity of concentrates required for this herd on an economic basis? (16 marks.)

4. Give a short account of the Coimbatore sheep. How are they ordinarily bred and reared? Suggest improvements. What practical methods would you adopt to improve the mutton and wool? (16 marks.)

*5. What would it cost to produce one pound of butter from buffalo's milk as against cow's? From the figures you obtain, consider the desirability of starting a ghee trade to meet the requirements of fifty middle-class families in the town of Coimbatore? Work out a profit and loss statement for a herd of milch animals maintained for this purpose.

6. Explain the process of ripening cream and converting it into butter What quantity of butter do you obtain from milk containing 5 per cent. of butter fat? What are the various details you are required to pay attention to in order that you may keep the butter sweet as long as possible? (16 marks.)

7. How do you feed calves? What is your view as regards weaning calves at birth in this country? Work out the cost of rearing a calf for one year. (16 marks.)

8. Write brief notes on:— (*a*) process butter, (*b*) homogenized milk, (*c*) pasteurization of milk, (*d*) milk powder, (*e*) whey, (*f*) starter, (*g*) pedigree, (*h*) Atavism. (16 marks.)

3. AGRICULTURAL BOTANY. I

Friday, 16th April. 7 A. M. to 10 A. M.

Maximum : 100 marks.

Answer six *questions.* Questions 2 and 5 are compulsory.

1 Enumerate the forage plants that are, or can be, grown in tropical India, and state how you would improve the fodder resources of the Madras Presidency. Taking any *one* fodder plant, describe it botanically. (16 marks.)

*2. Describe in detail the floral structure and the method of pollination in the following crop plants :— (*a*) sugar-cane, (*b*) cotton, (*c*) tobacco. (18 marks.)

3. State the directions in which there is scope for improvement in the undermentioned fruit crops, and the way you would effect the improvements :— (*a*) mango, (*b*) papaya. (16 marks.)

4. Describe the germination of pollen-grain and the process of fertilization. Mention the adaptations that exist in plants for the protection of pollen against rain. (16 marks.)

*5. Name the elements that are essential for the healthy growth of plants, citing experiments to show their essential nature. Give in detail the function of the following elements and their distribution in various plant parts :—magnesium, iron, boron. (18 marks.)

6. What difference in form and structure do you find in (*a*) submerged, (*b*) floating, (*c*) amphibious plants, as compard with mesophytes. Illustrate your answer with sketches. (16 marks.)

7. Name *four* perennial weeds and mention the family to which each belongs. Give an account of their distribution and the methods for controlling their spread. (16 marks.)

8. Write notes on :— law of limiting factors; plant pigments; enzymes; wilting coefficient. (16 marks.)

4. AGRICULTURAL BOTANY. II

Saturday, 17th April. 7 A.M. to 10 A.M.

Maximum: 100 marks.

Answer six *questions. Questions* 4 and 5 *are compulsory.*

1. Write a short essay on the salient features of the phenomena of linkage and crossing over. (16 marks.)

2. Bring out briefly the bearing of a knowledge of cytology on crop improvement. (16 marks.)

3. Give a short account of the genetics of rice as you understood it after your visit to the Paddy Breeding Station at Coimbatore. (16 marks.)

*4. A local sorghum variety has pithy stalks and yellow grains. A good imported variety has juicy stalks, but is red grained. Describe, generation by generation, how you would breed to fix the two desired recessive characters, sweet stalks and yellow grain. (18 marks.)

*5. What are the chief differences between rusts and smuts in their life history? (18 marks.)

6. Give an account of the reproductive process in ferns, and compare it with the same process in angiosperms. (16 marks.)

7. Describe in detail how you would prepare a pure culture of any fungus and inoculate a healthy plant. (16 marks.)

8. Write short notes on :—pure lines; alternation of generations; intergeneric crosses; mutation. (16 marks.)

5. AGRICULTURAL CHEMISTRY. I

Monday, 19th April. 7 A. M. to 10 A. M.

Maximum: 100 marks.

Answer six *questions.* Questions 1 and 8 *are compulsory.*

*1. Write briefly what you know of the contributions of (*a*) Liebig, (*b*) Lawes, (*c*) Gedroiz, and (*d*) Winogradsky to the progress of soil science. (18 marks.)

2. Discuss the importance of mechanical analysis in interpreting the fertility of a soil. Describe in detail any *one* method of carrying out such an analysis, explaining clearly the principles involved at each stage. (16 marks.)

3. Write notes on :—(*a*) deflocculation, (*b*) denitrification, (*c*) H-ion concentration, (*d*) base exchange, and (*e*) aluminium toxicity. (16 marks.)

4. How many tons of mono-calcium phosphate can be obtained by treating a ton of rock phosphate, which analyses 32 per cent. PO_4, with sulphuric acid? How much extra sulphuric acid must you use if the rock phosphate contains 3 per cent. of calcium carbonate as an impurity (assume no other impurities)? (16 marks.)

5. What is 'nitrolim' and how is it manufactured? What do you know of the course of its decomposition in the soil? (16 marks.)

6. How are alkali soils formed? Describe methods by which such soils may be reclaimed for successful cultivation, discussing clearly the principles governing their reclamation. (16 marks.)

7. Trace the historical development of our conception of 'humic acids'. (16 marks.)

*8. Describe, in detail, the process of liberation of ammonia in the decomposition of plant and animal residues by micro-organisms. What factors influence this process? (18 marks.)

6. AGRICULTURAL CHEMISTRY. II

Tuesday, 20th April. 7 A. M. to 10 A. M.

Maximum: 100 marks.

Answer six *questions.* Questions 1 and 5 are compulsory.

*1. State what is meant by 'respiratory quotient'. What is its average value for herbivorous and omnivorous animals? Give reasons for the difference.

An animal used up during a twenty-four hour interval 500 litres of oxygen, eliminated 425 litres of carbon dioxide, and excreted 12 grams of nitrogen in its urine. Calculate what amounts of protein, carbohydrate, and fat have been catabolized during the interval. (Respiratory quotient is 1·0 for carbohydrates, 0·7 for fats, 0·8 for proteins; one gram of protein, carbohydrate, or fat requires 1·0, 0·83, and 2·06 litres of oxygen respectively for combustion.) (18 marks.)

2. Write short notes on the following:—(*a*) the vitamins of milk, (*b*) the proteins of the wheat grain, (*c*) fasting metabolism, (*d*) renal threshold. (16 marks.)

3. What is a fat? How is it different from a wax? What physical and chemical constants would you determine to characterize it? Describe in detail the method of determining one of them. (16 marks.)

4. Comment on the use of the following as food for cattle:—(*a*) cholam straw (grown for fodder), (*b*) cholam straw (grown for grain), (*c*) paddy straw, (d) maize grain, (*e*) rice meal, (*f*) cotton-seed cake, (*g*) linseed cake, (*h*) lucerne. (16 marks.)

*5. Trace in detail the fate of the products of decomposition of proteins from the time they are absorbed from the intestine till they are excreted out of the animal body. (18 marks.)

6. What are the changes that take place during the deterioration of butter? How are these brought about? (16 marks.)

7. To what class of substances does lecithin belong? What is its importance in the lactating animal? (16 marks.)

8. How would you determine dry matter in a sample of milk? How and to what extent has the principle of the method been adopted in the commercial manufacture of milk powders? (16 marks.)

Madras Agricultural Journal

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Editorial.

Educational Reform. For the last few years there has been an insistant cry for a radical change in the system of elementary and secondary education in this country. Everybody seems to realize that the existing system does not satisfy the needs of the taught, but few, if any, are in a position to give concrete suggestions for framing a workable scheme connecting the various links in the chain. The proposals which have been recently placed before the public in a Madras Government communique should therefore strike those interested in the matter as something original if not interesting, at least as far as this presidency is concerned. We do not propose to discuss the proposals in any detail at present but would like to touch on one or two points directly concerning the agricultural aspect—if we may say so—of the suggested reforms.

One of the chief factors, which has acted as a drag on our propaganda work is most certainly the illiteracy of the farmer—we do not mean the *Mirasdar* or mere landowner but the actual cultivator—with whom our propaganda officers have to deal. During all these sixty and odd years since agricultural education on western lines was instituted in this presidency we have been attempting to manufacture a class of farmers from out of the educated landed gentry who have, neither by tradition nor inclination anything in common with the 'man behind the plough,' and with what result ? Our chief aim, viz., to induce the educated people to take up private farming has so far remained unrealized. This has perhaps been the experience in other countries as well so far as collegiate education in agriculture is concerned. These colleges have produced men qualified more for manning the departments of agriculture, as research officers or propagandists. But what about the short courses modelled on lines common in the West where men, women and boys actually engaged in farming take the fullest advantage of these institutions. Why are not these, started a few years back, in some of the farms in our Presidency not taken better advantage of by the farming classes than at present ? Why were the vernacular agricultural middle schools not a success ?

The answer is that the training which was intended for the benefit of the agriculturists could not be availed of by them because they had not had even a very rudimentary training in the so called three R's. On the other hand in the West where we have copied these systems from, compulsory primary education, without wastage before the minimum school-going age is reached, has created a class of farmers who are capable of taking advantage of the various opportunities offered to the educated farmer for improving his lot. Look at the large number of agricultural journals published for the benefit of the farmers—not too technical but concerning more about the day to day routine of farming life, on livestock and crops, containing pages after pages of questions and answers from actual farmers, regarding their difficulties and how they were in actual practice surmounted etc. etc. And where are we, still in the days of magic lanterns and coloured posters!! If only the agricultural classes had the necessary elementary education we are sure things would have been very different from what they are now. We do not confine this remark to agricultural improvements alone. It is therefore none too early for the authorities concerned to launch upon a bold policy of primary and secondary education on or similar lines indicated in the Government memorandum.

We have not got the details of the new Intermediate course suggested in the reformed scheme. But some modifications may perhaps have to be made in the present B. Sc. Ag. course in consequence, if and when the reform comes. It is now over sixteen years since the degree course was instituted in this college and it would be well to consider whether all is well with the present state of affairs. Changes in the syllabus, in examination etc., were brought about more than once during the last few years. We are however of opinion that the whole course could be modified with advantage still further. At present the course extends for three years. The standard of "Pure sciences" is certainly high and could any day compare most favourably with that in the other colleges in India or elsewhere; but as far as application or utility in after life, of the present course of study is concerned we are sure there could be improvement. With this in view and in accordance with the system followed in similar institutions in India and elsewhere we would suggest that the general course may be made complete in itself within two years with another year's specialisation in any two subjects, the degree to be conferred as at present at the end of three years. We are led to think that undue stress is laid and more than necessary time is allotted to subjects like Veterinary Science and Zoology. One year should be enough for learning first-aid in the former and getting a working knowledge of insect pests and their habits and anything more is not to be expected from an all round agricultural man regarding these subsidiary sciences. The syllabus may perhaps be on the same lines as for the L. Ag.

course in vogue prior to 1914 with the modification of specialising on any two of the following :— Horticulture, Dairying, Farm Management and Economics, Agricultural propaganda, Plant pathology, Agricultural Entomology, Agricultural Chemistry, Agricultural Bacteriology, Soil Physics, Agricultural Botany, Genetics, Agricultural Engineering, etc.

The final university product with this modified course of training will, we are sure, be very much better equipped for the work of a demonstrator, research worker or even a private farmer than the present graduates who get a general training in everything with no chance of specialising in any particular branch. The present day tendency is for specialisation whether in purely literary, scientific or professional education and it is high time that our college also provides facilities for our graduates to specialise in their favourite subjects thus enabling them to give the finishing touch to their scholastic career here alone instead of having to go elsewhere for the purpose as some of our men are now forced to do.

We dare say everybody interested in the matter would admit that there is a necessity for a change in our college curriculum on more or less the above lines and in view of the impending changes in the arts courses from primary up to the college classes we invite the earnest attention of all concerned to our suggestions. We have only just drawn a faint outline of the picture leaving it to the experts to fill in the details.

METHODS OF RURAL RECONSTRUCTION WORK DONE BY THE AMERICAN ARCOT MISSION AGRICULTURAL INSTITUTE, KATPADI.

BY S. A. KANAGASUNDARAM,

Vice Principal and Farm Manager, Agricultural Farm, Katpadi.

I take this opportunity of thanking the Madras Agricultural Students' Union for inviting the American Arcot Mission to take part in the lively activities of this conference. Perhaps some of you might have heard of and some have seen the American Arcot Mission Agricultural Institute, Katpadi. It is located about 4 miles away from the main Katapadi—Bangalore road. As one goes along the road winding in and out of the numerous barren knolls which are a feature of the tract, one wonders whether any farm can have its existence in such a place, but the visitor is amply rewarded at the end by the presence of a beautiful farm, demonstrating how best such an inhospitable and barren land can be made to attract and yield. This was made possible entirely due to the pioneer and untiring efforts of Mr. and Mrs. J. J. De Valois who have put their heart and soul into this project. I shall now, go through the past, the present and the future of the Institute.

The Past. The American Arcot Mission has never forgotten the importance of the rural life of India in all its fulness and of the lines of spiritual, mental, physical, social and economical aspects of it. In pursuance of this policy, in 1918 it was decided to fit in the economic aspect, as rural conditions demanded. So, need for work in Agriculture was felt and a plan was presented to the Government and a trained Agricultural hand was also appointed to be in charge. This led the Reformed Church in America to raise $ 14,900 and to send Mr. and Mrs. J. J. De Valois to India.

The Government offered the Mission 175 acres of land near Katpadi. In 1923 the missionary house was built and occupied. A vigorous programme of work was then carried out, such as digging of wells, laying out plots, bunding and tracing the fields, planting of trees, providing quarters for the staff and building of the school and hostel. The first batch of boys were admitted in 1924. The period from 1923 to 1930 was mainly a pioneering one and gave valuable experience in chalking out for the programme of work.

The Present Activities. *Poultry Raising.* A leading part in the development of the improved poultry farming has been taken in the Presidency. The foundation stock of our pens is a flock of 197 adult birds imported from England and America. Well over a thousand birds are at the farm besides the innumerable ones sent to various

parts of India and outside countries like Burmah, Siam and Arabia. Our aim is to make poultry raising a subsidiary industry enabling the poor villagers to add a little to their income. Almost all the villages round about Katpadi are now having pure and cross bred birds earning a part of their livelihood through the sales of eggs at our Rural Development Egg Marketting Centre at Katpadi.

Cattle Breeding. " Cattle is the back-bone of the farmer in India " but in almost all the villages, the specimens found are such as to evoke one's sympathy. Breeding is haphazard, there being no regular organization. To raise the standard of the milch and draft animals, breeding bulls and buffaloes have been stationed under the Government premium scheme at various places round about our farm for the benefit of the villagers. Apart from the *Scindhi* and *Kangayam* stud bulls stationed at the Farm, the Institute has sent out about a dozen bulls to the villages round about the farm for breeding purposes and as the result every year more than 600 cows are served and at least 500 calves are born to the pure bred sires of both the breeds.

Goat Rearing. There are nearly 11 million goats in the presidency, but they are of non-descriptive variety. Goat's milk though a valuable food is not in general use as an article of food. Goat is " the poor man's cow, in as much as eight milking goats can be kept on the amount of feed that one cow would require."

There are two breeds of goats *Surity* and *Jumnapari.* These pure bred bucks are made to cross with the country goats to grade up the country breed. As the result we have now in the villages and in the farm about 100 cross-bred goats. Many are sold for a higher price than the country ones. Thus the villagers have begun to realise the benefits of goat breeding. The goats have gone not only to many places within the district but also to many other districts. The institute is expecting the final sanction for a scheme of goat breeding from the Imperial Council of Agricultural Research, New Delhi. The Institute with a view to make a quick propagation has lent out about 100 goats on *Varam* system in many of the villages. Associated with this the problem of fodder is tackled and we are using pit and trench silos with success in addition to the cultivation of fodder crops.

Conservation and Use of Manure. Not to speak much about the very low humus content of our land we have to admit the considerable loss of it through ignorance and negligence. Proper preservation of cattle manure by the loose box, dry earth, the manure pit and compost systems and the growing of green manure crops are all regular items of demonstration in our farm.

Improved Implements. Improvements which will meet the desired end and do not involve much expenses to the ryot are being incorporated in the local implements, and labour saving methods of cultivation and irrigation are practised.

Diversified farming. Paddy, the staple crop is produced under the most uneconomical conditions in these tracts. To make the farmer work better, to find him work all round the year and to provide himself and his family a better diet, cultivation of fruits and vegetables is being advocated.

Rural Community, Agricultural bias, middle school. In 1930 this phase of activity was begun at the farm. There is a hostel which provides accommodation for over 70 village boys, and over 80 day-scholars attend the school from the neighbouring villages. Government syllabus is followed allowing them to continue higher studies. Both theoretical and practical courses are given to these boys on dry and wet crops, home and market gardening and animal husbandry. All the students do two hours practical work daily on the farm and are able to raise by their own offort enough vegetables and fruits and also to produce sufficient quantity of milk, eggs and grain. The educational value of such a programme is very striking indeed. After finishing this three-year course, which provides an agricultural bias, some of these boys take teachers' training and become teachers in the villages while others take up cultivation or other work in their own villages, thereby creating a really efficient source for enlightened village life under the "Back to the village" system. Though the farm is located in a secluded spot, the attention of people engaged in rural development has been drawn to it and we get a steady stream of visitors and ryots. Some of them stay for a few days and get thoroughly acquainted with all the activities of the farm, while others exchange ideas of mutual benefit.

Summer School and Short Courses. A 'Summer School' was started in 1929. The villager who found his work slack, was invited to undergo a short course at the farm. Our object was to infuse a desire for a better village life and living Thus the students of the Summer School were adult men and women teachers, farmers and local leaders. These were given short courses on the scientific methods of cultivation, preservation of manure, poultry raising, and other cottage industries. Entertainments, dramas and *bajanas* were conducted at regular intervals.

Extension work done by the boys and village scouting. In addition to the regular school work, the staff and students of the school have selected three different villages and done some work under the following methods. The school is closed on a Friday morning, the staff and the boys are divided into three groups reach the village by walk and make the necessary preparation for their stay for two days in the village. On Friday evening a variety entertainment is given to the public containing lessons on uplift work. On the following morning the boys all dress in Khaki, go about the village and give practical demonstrations such as conservation of manure by the dry earth

system, digging of manure pits, and cleaning of wells. They go about with spades and crowbars, and repair the street roads. In the evening the boys enact a drama on a subject like health, temperance or uplift work which usually lasts to the dawn of the next day. After doing some more work on Sunday they return to the farm on Sunday night to begin the regular school work on Monday. This is done by the staff, including the principal, their families and all the students. This is done three times in a year. The result is many, of the village people have understood the value of conserving manure and to keep their streets and wells clean.

Rural Development Centre, Katpadi. On Mondays, Wednesdays and Saturdays eggs are brought from at least 20 villages and they are tested and graded by electricity and are despatched to different places by rail. Eggs are supplied to different places, hotels, stores, agents and to individual families in different grades and at different rates. To some clients more than 40 dozen eggs are being sent on alternate days and a regular supply of 60 dozen is made twice a week to the Madras Civil Orphan Asylum. By this the poor villagers make a lot of profit and we promise to take all the eggs that they can produce. Cloth is bought in large quantities direct from the mills at Madras and are sold both as cloth and ready-made dress at rates cheaper than the usual bazaar prices. By this the poor villagers are benefited. Fruits and vegetables, such as tomatoes, papayas, guavas and brinjals are brought to the Centre from the villages and are sold to the customers thus helping the marketing of the produce of the villagers. There is a Rural Circulating Library from which many villagers are benefited. The same hall is used as a free reading room which has one English paper, one Tamil paper and a good number of English and American magazines. A family is set apart for the Centre work, the husband being in charge of marketing and the wife in charge of the library and reading room. One of our staff is set apart to supervise the work done in the villages on all these lines at regular intervals. During the past year our Marketing Centre has purchased over 72,000 eggs from the village people paying them over Rs. 2000 for the same. Over 1000 books on various subjects have been circulated and read in the villages through our circulating library.

Work done by the Agricultural Institute under the North Arcot District Economic Council. In accordance with this scheme, work is being done by introducing poultry and stud goats in many of these centres. Exhibits were taken to all these centres during the Village week celebrations, lectures were given during the public meetings under the chairmanship of the respective Revenue divisional officers, strongly emphasizing the methods of poultry raising and its benefits. A special lecture was delivered at the Ryots' Conference held at Vaniyambadi under the presidency of S. A. Venketaraman Esq., I. C. S. the district collector of North Arcot and the president

of the District Economic Council. The Economic Council has sanctioned Rs. 3000 for three years at Rs. 1000 per year. The Institute thanks the Council and its president for the financial help and for the opportunity given to the Institute to do this piece of work for the improvement of the villages.

In addition to the exhibitions held in all the eleven model villages in connection with the village week celebrations under the District Economic Council there were three special exhibitions held during the year.

On the 12th. and the 13th. March 1937 a big exhibition was held at the Rural Development Centre at Katpadi in a specially erected *pandal.* The Animal Show of the S. P. C. A. of Vellore was combined with this exhibition. Many of the Government Departments i. e., Agriculture, Veterinary, Cooperative (button factory, ratan work, shoe making etc.). Fisheries and the Red Cross society took part, bringing their exhibits also. The Assistant Director of Agriculture held the inspection of the breeding bulls and conducted a ploughing competition on the exhibition grounds. There was a great show of poultry, goats, cows, calves, grains, fruits, vegetables etc. and prizes were awarded. Sports and games were conducted. A radio was set up and entertained the public for two days. Public processions were conducted with music with the bulls, goats, fowls etc, through the town. A public meeting was held over which the District Collector presided. The principal gave a report of the work and Miss G. Dodd gave away the prizes which consisted of valuable brass vessels and other useful utensils.

More or less the same programme was followed at the Rural Exhibition at Ponnai Anecut in Walaja Taluk, Ranipet Division on the 19th. and 20th. April 1937 where hundreds of village people camped with their families under thatched sheds. Ploughing competition, sports and games, poultry crops, fruits and vegetables were all exhibited and the usual prizes were given away. On the 22nd. and 23rd. April 1937 the same kind of exhibition was held at Virudampet near Vellore on the banks of the river Palar.

The Future: Goat breeding scheme for the production of a better breed, by crossing *Jumnapari* and *Suriti*, the reputed heavy milk yielders and good meat producers with the local selected stock is an important one and we are attempting to do this work with the help and cooperation of the Imperial Council of Agricultural Research, for South India in general and with the guidance of the North Arcot District Economic Council for the district in particular.

More intensive work on the above lines and the development of all the present activities with the help of the Development Department are our future plans.

Summary. Statistics are dry reading but may be the best way to sum up accomplishments of the past. We have imported 137 fowls from America and England through the years in order to build up our poultry. We have terraced and bunded 60 acres of land and brought it under cultivation. Where in the beginning we had only palmyra trees with no shade even for a poultry run, to-day we have 1000 mango, 60 guava, 80 papaya, 135 lime, 123 orange, 50 coconut and 300 tamarind trees a total of 1,800 fruit trees, not to mention the thousands of shade, fuel and avenue trees in addition. We have 2000 fowls on the farm; we own 32 cattle and breeding bulls; our herd of goats has grown from 15 does in 1932 to over 100 to-day. Our registers show over 600 services a year by our breeding bulls and we have trained 182 men and women in our Summer schools. We now have a complete Higher Elementary School with 155 boys and girls and a staff of seven well qualified teachers. A total of about 600 boys and girls have attended and passed through our school during the past years. Our finances are met by the Mission funds and from the Government grants and we thank the Government for the support rendered to us.

Conclusion. I wish to conclude this paper with the fervent hope that God may bless this piece of work which is slowly but steadily progressing. It is our earnest hope and prayer that God and man will cooperate in this glorious work and do their part to bring the thousands of villages of our dear mother land of India to a better condition in all its phases of work. Let India attain first the *Swaraj* of rural uplift, freed from the dangerous clutches of drink, dirt, debt and disease.

"Let us be on the alert and be prepared to do our best."
"Let our actions speak louder than our words."
"God helps those that help themselves."

ADULT EDUCATION FOR RURAL RECONSTRUCTION

BY J. N. JAYAKARAN,

Y. M. C. A. Rural Reconstruction Centre, Ramanathapuram, Coimbatore.

After several years of experimentation in rural reconstruction work, we, workers of the Y. M. C. A., came to definite conclusions regarding the fundamental principles that must be recognised by any programme which aims at lasting success.

Rural uplift becomes impossible if service is directed to one or two or more, but not all of the villager's needs. The programme has to be sufficiently comprehensive and its execution simultaneously directed to all his main needs. In other words, it is practically futile to confine rural work to the economic, the health, the social, the moral or any other needs of the villager. Success is possible only when all sides of rural life are approached and that simultaneously.

Rural reconstruction is impossible except in so far as it is a process which is worked from within. All work directed from without is transitory and has value only so far as it secures action by and from within the village itself. When this is forgotten, much of the services that is done, however valuable in itself, is quickly lost. Not only is it a waste, but also it undermines faith and retards normal progress. All rural reconstruction work should be severely conceived and carried out as a species of education. Not education in the ordinary sense; but as Adult Education irrespective of literacy. That is the only method that is really possible or justifiable. Every line of service should be conceived and worked out as a part of education. Take for instance, co-operative credit. Even that service should not be worked out merely as a banking concern for providing relief to individual villagers from the grip of the usurious money-lender, but as an educational agency in regard to economic values and joint action, and for education and training in rural leadership. It is one thing to work the co-operative society as a bank and a totally different thing to work it as an educational agency even when confining that education to purely economic affairs. In the same way, service along all other lines should be thought out and carried out as various means of one central process of adult education. This will mean slower and more difficult work, but everything that is done will abide and become creative in its turn.

It is a fallacy that adult education should begin with conferring literacy and then proceed to build on it more or less along lines of modern school education for the young. Should literacy be indispensable for adult education, we must give up the task at once. Happily, literacy is not indispensable to education which in its broad sense is only the transference of ideas from one to another. And this can be done in more ways than one. In the situation in India, with our problems so many, so diverse, so complicated, so urgent, and all the time becoming more and more grave with the steady and enormous increase of population, we indeed have no time to wait for the literacy of our people, but have to endeavour by all means to perfect a system of adult education irrespective of literacy. In all our plans and programmes the query should be, how much will the illiterate person get out of this? If the literate person gets more, it is all to the good. But the test should be the effect on the illiterate person. Nothing should be reckoned as satisfactory or sufficient which benefits only the literate and leaves the illiterate aside. It is not meant, however, that the conferring of literacy should not be designed as a part of the general curriculum of adult education. It need not be given a central place.

We must remind ourselves that we are dealing in our villages with one of the most settled communities in the whole world which is now

finding it almost impossible to adjust itself to modern requirements and standards which have come upon it with an insistence which is a challenge and a help. The process must be operative from the innermost citadel of what was once a completed structure and still remains a substantial one though battered on many sides. The resources for its reconstruction must be provided as far as possible from within the village and the real workers must arise there. Our part is merely providing the necessary education towards that end.

There are in village life several admirable institutions which can be turned to excellent account in the carrying out of such an educational scheme.

The Weekly Market. In India, this is a ready-made adult school. Practically, the whole village is there; and the same set of people flock there week after week. Any one who hires a few stalls and offers something attractive gets his chance freely with the whole crowd. Striking exhibits and charts should be displayed and simple talks related to a present problem, say, for instance, the price of groundnut or a pest which attacks a standing crop, given. More general topics can be introduced gradually in the course of the discussion of the specific problem of the villager. Lecturers are not difficult to get. In every district the Government has experts in several lines which are of practical importance to the villager. But they do not go about all the time to teach the rural folk. They do things if and when called upon to do so. In fact, most of the villagers do not even know about the existence of such experts. Some prominent place in the weekly market is a very natural means of bringing the two together. Looking at the exhibition and the charts and listening to the simple talks, the villager is naturally challenged by the advantage which comes from literacy. He can and does get an enormous amount of information and suggestion through the eye and the ear though he is not able to read and write. But he comes almost every week to a situation when he observes the advantages of those who are literate. He begins to crave for that advantage at least for his children. This effect is analogous to what has been proved to have happened among the Negroes of the United States when the peripatetic schools from Hampton and Tuskegee went among them.

The weekly market lends itself to continuous instruction in sufficient detail, as it is mostly conducted in the form of questions and answers. So, the results can be gauged and judged from time to time. Sale of better implements, seeds and fertilisers, poultry and bees and other things which we wish to introduce, can be done. Every such transaction is an occasion for more questions and answers. Books, pamphlets, bulletins and leaflets can be received and issued on that occasion.

In all these operations one should constantly keep in mind the educational aspect. As far as possible, our share should be confined to guidance. The actual work should be shared more and more and finally taken over entirely by the villagers themselves.

The Village School. The day school is for the young. The teacher's duty is supposed to come to an end in the evening when the pupils have left. The building is kept shut for the night. What an opportunity for Adult Education commences just then ! The teacher could come back at lighting time when the village folk have returned from their daily toils. Talks, lectures, songs, *bhajanas*, lantern shows, classes, readings from newspapers, bulletins or pamphlets—anything can be done provided two wants are satisfied, namely,

(a) Our teachers' training schools should prepare rural schoolmasters to consider their schools as community centres and to work them as such.

(b) Assistance should be given to those schoolmasters by people like us to keep this side of their work up to the standard.

The Village Theatre. No village in our country appears to be incapable of improvising a theatre even at short notice for entertainment purposes. The traditional means of adult education employed for thousands of years in our country is music, song and story. A combination of these in the dramatic form is the most effective means for reaching the whole community, young and old, men and women. The didactic purpose has not detracted from the artistic standard of the drama. Plays with a purpose like *Harischandra* and *Nandanar* judged on purely artistic merit compare very well with the front rank productions of any literature. Therefore in the revival of the drama which is now preceding, we find some of our best talents interested in the writing of new plays suited to the needs and tastes of the present generation ; and it should be our endeavour to keep the material improved all the time and to give the villager always the very best available. We should be having newer plays written all the time and they should be better every time. The main aim being education, the play should clearly convey certain ideas which are practicable to-day to the villager as he is. These special ideas which a play aims to convey should be in song form and set to popular and easy tunes. Then they catch the attention, grip the memory, and circulate in all the villages, literally singing themselves into the minds and eventually the lives of the people.

The village theatre as a vehicle for education could be most effective if the actors are raised in the village itself. Happily, the histrionic art comes naturally to us, Indians, whether we are urban or rural. In every group of say, 20 villages, anywhere in this country, there is enough talent for any play which we wish to stage for their

education. But we should get as able a man as possible to do the training. And there should be as much continuity as possible about this training so that the acting, singing and the music do improve all the time. The actors could be illiterate, but still education is there. The audience of the night and those many more who are not there but who will be singing the songs of that play for years, none of these need be literate.

Co-operative Society. Although this is of very recent introduction into the village, the principles on which it is based are not new to India. That the working of a co-operative credit Society is in itself a very rich means of education, need not be doubted by any one.

(a) The co-operative society often answers to an utterly desperate need of the villager and therefore when wisely handled, it becomes a powerfully-effective lever for his uplift along many lines.

(b) The co-operative society is a specific social organisation. It trains people in combined action, it disciplines them in following the leaders chosen by themselves, and it chastens the leaders in having their policies and actions guided in a democratic way, thus furnishing a model for corporate activity along many lines and drawing out workers from the community and training them as it gathers strength. There are indeed other direct values, ethical and economic, which need no recounting here. To any one who is willing to take advantage of a co-operative society as a means of adult education, it is full of wonderful possibilities.

Enough has been said to show that the means for adult education are already existent in the rural areas themselves. Extension lectures, university settlements, community centres and such like are not necessary excepting for training workers and for administrative convenience. For the education itself, it is far better to utilise existing institutions and opportunities, with a curriculum which is as comprehensive as are the actual practical needs of the villagers.

SOME ASPECTS OF RURAL RECONSTRUCTION

BY Miss B. M. TWEDDLE,

Methodist Mission Village Industry, Tiruvallur.

The subject in which I am interested is village industries, and my contribution to this conference will be to give you a brief survey of the work we are doing in Ikkadu, a small village in the Chingleput district, thirty miles from the city of Madras, and in the light of this experience see how it can be applied in other places.

To you who know India so well it is hardly necessary to dwell on the appalling poverty of the majority of the village people. It is one of the most urgent problems with which India is faced today. It was

in an endeavour to ameliorate these conditions in the surrounding villages that industrial work consisting of weaving, lacquer work, embroidery, lace, machine work etc., was started.

To-day much is written of "Rural uplift" and the development of village industries, but the urgency was realised, and the work organised in Ikkadu many years ago, and now we are well established. Our aim was first to establish our head quarters in Ikkadu for teaching and training in weaving and other subjects, and afterwards to open smaller branch institutions to serve a chain of villages too far away to be in daily contact with the head quarters in Ikkadu, and to organise cottage industries in the surrounding villages.

A start was made in a mud and thatch hut with very little capital as Mission funds were not available for this purpose. A further expenditure was necessary for looms, yarn etc., all this meant considerable organising, and financial anxiety, but in spite of unspeakable and at times almost insurmountable difficulties the work expanded. Workers crowded in and the time soon arrived when the limited and unsuitable accommodation was seriously handicapping the development of the industry and suitable and adequate buildings were erected. The new building is square, all the weaving sheds are built round a central garden and the workers now number over two hundred. Christians and non-Christians of all castes and creeds are working together under healthy and pleasant conditions and are under medical supervision. If only that could be said of all hand looms in India, one is struck by the difference between our weavers and the ordinary village weaver. There is no more depressing sight than to see the emaciated form of a village weaver standing in the pit of his loom working in a small room with a window about 18″ square. A tiny lamp hangs over the loom as they often work far into the night and start the same monotonus grind early the next morning.

Our Aims. The aims we have in view are the following:

1. Training boys to become weavers as full time workers.

2. To train agricultural workers for part time weaving and afterwards to hire simple looms to them so that the workers can weave at home and put to good use the many days during the year when they are unable to work on the land. These workers receive yarn from our head quarters and return the finished cloth for which payment is made without delay.

3. To train women and girls in embroidery, lace, etc. After a time our goods found a ready market and the work expanded and to-day "Ikkadu goods" are known throughout India. Those who do not work at home, come in daily from the surrounding villages. There are sixty-four women workers residing in the women's hostel

attached to the institute. These women come for training from all over the presidency. There is a small hostel for men where there are at present eighteen in residence.

The women do the winding for the weaving, and embroidery, lace, machine work, etc., and the men the weaving. The latter earn on an average Rs. 20 per month. Today there are boys doing attractive and difficult designs, who knew nothing about weaving two years ago. Every month close on Rs. 3000 is paid to the workers and Rs. 500 to the staff. This money is all raised from sale of goods; we have no other source of income apart from a very small grant from the Department of Industries.

Markets. As you know the success of an enterprise like this depends largely on the market. A market does exist for the right articles. Much yet has to be done in organising and in the developing of markets in connection with village industries, and much can be learned from Japan and China and the survival of small industries in Japan would repay careful study. When visiting wholesale houses in London I found that China and Japan are in much closer touch than India. We must not be afraid of producing goods for export; many countries thrive on exports and there are hand-woven fabrics being sold in London to-day at fabulous prices which could be made in India on a much cheaper scale. That means that hand-woven fabrics from India would find a ready market in London and other places if the organisation existed.

Organisation needed. Why cannot, what has been done in Ikkadu in a small way, be repeated in other places in South India ? It is important to keep the people contented in the village instead of crowding into the cities and this is the only way. There is on the one side a vast army of idle people with natural skill of craftsmanship and there are so few ready and willing to organise this vast store of labour. Why aren't there more people ready to study village problems and help to alleviate the distress? Village Industries on Ikkadu lines in important places throughout the Presidency would be a great help to village people.

THE SILK INDUSTRY AND RURAL PROSPERITY IN KOLLEGAL TALUK

BY S. KRISHNAMURTHY, B. Sc. Ag.,

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Sericulture as a Home Industry. In a programme of rural reconstruction, the problem of a suitable home industry finds a prominent place. Many of the cottage and village industries in India, have declined, having succumbed mainly to large scale industrial organisations. But sericulture, as a cottage industry, has right through

withstood the competition of any such organisation. It is because, it has always been a poor man's industry, allied to the main profession of agriculture. It is, in fact, best followed with success where wages are low, holdings small and the agriculturist has enough time between one crop and another. Sericulture, as a home industry wherever it can be taken up, has few equals. It has all the advantages of hand spinning of cotton but is less exacting and more profitable. This industry, has therefore, come as a boon to Kollegal, where dry cultivation is the rule, the ryot is poor and has time to spare between crops.

It is my intention in this paper to emphasise the very important part which sericulture has played in the rural economy and prosperity of Kollegal taluk of Coimbatore district. This taluk is unique in being the only centre in the whole presidency, where the industry forms the main subsidiary occupation of the people. It is carried on under purely cottage conditions by all agricultural classes, in almost all the villages.

Suitability of Kollegal for Sericulture. Kollegal is a part of the Mysore plateau, 2000 to 2500 feet above sea-level, is sub-tropical in climate and is admirably suited to the rearing of silk-worms and the production of silk. The suitable temperature, for the industry, is said to be between 75° and 80° F, and humidity between 50 and 70 per cent. These conditions are mostly satisfied by Kollegal and Mysore. In fact, Kollegal owes its industry to Mysore where it was established in the days of Hyder Ali and Tippoo Sultan. Since those days, the industry has been so intermingled with the agricultural economy of this taluk that every phase of the industry has told on the prosperity of the people.

Importance of Kollegal as a Silk producing Centre. Though only a taluk in Madras province, Kollegal ranks among the principal silk producing centres of India. The Coimbatore District gazetteer (1933) states that in previous years, Kollegal's silk exports ranged from 50 to 60 lakhs of rupees. Kollegal was the chief centre of supply of raw silk for this presidency till the imports of silk from China and Japan and of artificial silk became a menace. The importance of this industry will be better understood, when it is stated that, according to the Tariff Board report, the number of persons depending on silk-worm rearing in Madras, was 1,20,000 in 1931—32. Surely an industry that supports this number, is important for the whole province.

The Branches of the Industry. To understand the economic significance of this industry, it is essential to deal in a brief manner with the branches of the industry, so as to bring out the economic aspect of each branch, as it affects the rural population.

Kollegal, along with Mysore, has a distinct race of silk-worms. These worms are multivoltine, fed on mulberry leaf and produce

greenish cocoons, yielding a beautiful lustrous silk of excellent quality. The industry divides itself into three branches, viz. (1) The cultivation of mulberry with the purpose of obtaining the leaves for the silk-worms, (2) The rearing of the silk-worms from the egg-stage to the cocoons and (3) Reeling of silk-thread from the cocoons.

Cultivation of Mulberry: The mulberry garden is the principal, capital investment of a silk-worm rearer. His other requirements are few. It can be said in general, that mulberry occupies one-tenth of the total area in the taluk. A silk-worm rearer, generally, has his own mulberry garden. The cultivation of mulberry commends itself to the ryot for important reasons. Once planted, a mulberry plantation is kept on for 8 to 10 years. Cultivation is easy and not expensive. For his intercultivation, the Kollegal ryot is used to his indigenous, labour-saving, bullock-drawn implements called *guntas* in Kanarese. On careful investigation, I have found that it costs about Rs. 28 per year to cultivate an acre of mulberry. In years of insufficient rainfall a well established mulberry garden withstands drought better than other crops. In such years, rearing silk-worms has saved the ryots from the consequent acute general distress. In spite of the present poor price of silk, there has been no inducement to the cultivator to substitute entirely the food crops for the mulberry because in these years of trade depression, the fall in prices of food crops has been greater than that of raw silk, though serious the latter has been. Mulberry is thus a money crop to the Kollegal ryot. It provides him, in the form of cocoons, cash for his cultivation expenses and his necessities of life. For his food, the ryot generally grows his own food crops. It is estimated that an acre of mulberry produces about 4000 lb. of leaf per year, enough to produce about 300 lb. of cocoons or say 12 *maunds* worth nearly Rs. 100 at the present prices.

Silk Worm Rearing. According to the census report of 1931, there are at least 5000 families engaged in rearing of silk-worms. This works out to nearly one-third of the population of the taluk. The rearing of worms is carried on side by side with the cultivation of mulberry. While the farmer looks after the cultivation of mulberry, the rearing is looked after by the women and children of his family at home, who furnish all the labour required. The rearing room is a part of the house. It is this fact that makes Sericulture a perfect home industry. In this connection, the following passage, occurring in the Census Report of 1931, about the Silk industry in Kollegal is interesting :— " Women folk play a considerable part in the rearing of silk-worms and the care and vigilance that they bestow upon the rearing of worms are largely responsible for the considerable progress that has been made in the industry." In that report, it is estimated that for every 1000 men, 2108 women are engaged in silk-worm rearing. The women in this taluk are thus an economic asset.

Thus, this industry, by making use of the family labour which would otherwise go to waste and by also employing the spare time of the agriculturist, turns the waste into wealth. This is a gain, not only material, but also moral. The intial equipment necessary for an average grower costs about Rs. 12.

The care with which the worms have to be looked after, from the hatching of eggs to the spinning of cocoons,—especially with regard to feeding with the right quality and quantity of leaves, at proper frequency, according to age and with regard to stopping and resuming feed at the proper time before and after moulting,—cultivates a certain alertness of mind and a spirit of co-operation in the family, without which the rearing will not be successful.

The scrupulous cleanliness with which the worms have to be handled and the need for cleanliness in the surroundings (without which, the worms cannot thrive), promotes a sanitary sense in the village. The silk-worm litter is carefully collected and fed to cattle and is very much relished by them. It is rarely thrown away in the manure pit.

Seed Production. In Kollegal, as in all other places, where Sericulture is established, the production of seed cocoons is a separate branch of the industry and this gives employment not only to those who produce the seed but also to the vendors who buy from them and sell to the rearers.

There is another branch of this seed-production, which has a scope for employment of trained men in the rural areas to the great benefit of the rearers. I allude to the production of disease-free seed. The silk-worms are particularly prone to diseases, especially Pebrine, which is hereditary and contagious. This disease once threatened the extinction of the industry in Europe, especially in France, which was saved, by the timely researches of that great scientist, Pasteur. It is, by his method of elimination of every diseased laying, whose female moth by microscopic examination shows the existence of pebrine, that the disease-free seed is produced. But for the control of this disease, the industry might not have been what it is to-day. It has thus to be understood that the production of disease-free seed is most important in sericultural development. The Government have therefore concentrated their efforts in this direction. They have established farms at Kollegal, Hosur and Palmaner for producing disease-free seed. They have also stationed a party called the Peripatetic Rearing party at Kollegal who distribute this disease-free seed, buy cocoons themselves from reputed vendors, prepare and distribute disease-free layings, and also induce the ryots to get their seed, tested for disease. The demand for disease-free seed is being increasingly met every year by the sericultural section of the Department of Industries. Thus, while, in the year 1931–32, the proportion of disease-free seed

supplied, to the total requirement, was only about 10%, it can now be said that it is more than 40%. There is nearly 60% still to be supplied, which offers a scope for private enterprise. This in fact, is encouraged by the Government, who give financial aid to private grainages. According to the available statistics, 1,260,000 lb. of cocoons worth Rs. 4,20,000 were produced in 1931—32.

(iii) *Reeling.* This is a separate and important branch of the industry. These cocoons, as differentiated from those of Eri silk-worms, consist of a continuous thread of silk-fibre. Reeling consists in unwinding these continuous threads from a sufficient number of cocoons at a time and joining them together to give a combined thread of desired thickness. This is done by a hand-driven *charka*, which reels the thread from the cocoons placed in a basin of hot water. In 1931-32 the number of such country reeling machines in Kollegal, was 500, giving employment to about 2000 people. Besides the professional reeler who reels the silk thread from the cocoons, women are employed to turn the reel and men to supply water and fuel to the basins. From the statistics available, it is learnt that 90,000 lb. of reeled silk worth Rs. 4,50,000, were produced in 1931—32.

Besides the raw silk that is produced, the reeler gets the silk-waste as a by-product which has till now been exported to foreign countries for being converted into spun silk. But with the establishment of a spinning plant in Mysore, silk-waste will have an easily accessible market. The statistics show that there was 45,000 lb. of silk waste in 1931-32 worth Rs. 8,000.

Weaving. The last branch of the industry is the hand-loom weaving which is also a cottage industry. The handloom weaver, not only in this taluk, but also in the other principal weaving centres in the presidency, was dependent on the raw silk, mainly of Kollegal, till the cheap foreign silk and artificial silk lured him. The seriousness of the competition from China and Japan will be known from the following, obtained from the Census report of 1931 :—

The imports of raw silk in the presidency in

1915—16 was 5.62,18 lb.
1929—30 ,, 8, 25,930 lb.

valued at over 47 lakhs of rupees. Whereas, from the same report, it is learnt that in 1911, out of the 8,00,000 lb. of raw silk consumed in the province, 360,000 lb. was from Kollegal, 3,00,000 from Mysore and only the rest from Bengal and China. As the handloom weaver is the main consumer of raw silk, on him depends to-day the scope of expansion of the industry.

Marketing. Silk is generally marketed through a chain of merchants or commission agents. There is no sorting or grading. The

marketing of silk is thus backward. With higher efficiency in marketing which is bound to come, as a result of establishment of a central marketing organisation, this industry should also benefit.

The decline of this industry, due to foreign competition, was brought to the notice of the Government who instituted an enquiry by the Tariff Board in 1932, which has been helpful to the industry and protection for the present has been given. If such an important and interesting industry should, for any reason, disappear, we shall be losing an industry on which depends the livelihood and prosperity of a large rural population.

To Sum up. (1) Sericulture is a perfect home industry. (2) It occupies an important place in the rural economy of the taluk. But for this industry, the poor ryot of Kollegal, would have been frequently faced with starvation. (3) For the cash, which the agriculturist requires, for his necessities and his expenses between one harvest and another sericulture helps him. At any rate, it gives him credit-worthiness. (4) Apart from the material advantages, the industry induces mental alertness and co-operation. A sericultural village, especially previous to the trade depression had a characteristic atmosphere of life and prosperity and even to-day looks more resistant than an ordinary village, to the havocs of trade depression, irregular rains and unemployment among labouring classes.

The Industry in General. With reference, in general, to the industry in India, there is a great possibility of expansion. It is estimated that India consumes about double the quantity of raw silk which she produces. With better methods of cultivation of mulberry, of rearing of worms, reeling, marketing and a better organisation of handloom weaving there is no difficulty for expansion, as India has all the natural advantages for the industry. In fact, the expansion of silk Industry, in places wherever possible, will open up fresh avenues of employment for the rural population.

Acknowledgment. I take this opportunity to thank Mr. K. T. Achiah, the Sericultural Expert and Mr. Ramachandra Rao, the Silk Superintendent, who kindly afforded me facilities for studying the industry, while I was in Kollegal.

Research Notes.

The White top shoot borer of sugarcane (*Scirpophaga*)

Mention has been made in the previous publications on the top shoot borer of cane about the presence of two species of *Scirpophaga* in South India, at any rate, in the Madras Presidency. These are *S. monostigma* and *S. auriflua* (*S. xanthogastrella*, *S. intacta*, *S. nivella*) the former with a black spot on each of the forewings and the latter without spots. In our recent studies of the pest it was found difficult to distinguish the larval and pupal stages of the two moths and this led us to suspect that there may be only one species after all. The

caterpillars batching out of the eggs laid by the two moths were therefore reared separately in pot plants inside wire gauze cages. It was found that both the spotted and spotless forms were got from the progeny of either. It was also observed that there were gradations even in the size of the black spots. Some moths had prominent spots with about 100–150 black scales while others had very few such scales. So it looks as if there is only one species of *Scirpophaga*. Detailed studies including the examination of the genetalia of moths and rearings of larger number of caterpillars are in progress to confirm the results already obtained.

Agrl. Research Institute,
Coimbatore.
Dated the 10th August '37.

M. C. Cherian,
C. K. Subramaniam.

EXTRACTS

Jelly Making. One of the most important things in making jelly is to get the fruit at the right stage. Half-ripe fruit is necessary to make good jelly. The proportion of sugar is generally 1 cup to 1 cup of liquid. Boil juice for 10 to 15 minutes Add sugar and boil quickly from 10 to 20 minutes when it should be tested by putting a little on saucer. Any strong material with a close weave answers almost as well. Before straining jelly, the bag should be wrung out with clean, hot water. The last of the liquid should be allowed to drip slowly through the bag unaided by pressure. To strain small quantities of jelly, reverse a chair and place the seat flat on the table, tie cloth to the four legs, and place bowl under cloth.

Recipes. Apple Jelly.—Take as many apples as required, windfalls will do, and small ones are the best. Place in a preserving pan with enough water to cover them; when boiled to a pulp, do not stir, strain through a jelly bag, and to every breakfast cup of juice add three-quarters cup of sugar. Boil briskly until it jellies, and pour into jars. Exclude air from jars either by covering with paraffin wax or paper moistened by being applied to jar.

Lemon jelly.—4lbs. of lemons cut in slices in 4 quarts of water. Let stand all night. Boil for half an hour. Stand until next day, strain through flannel. A cup of sugar to cup of juice. Boil from 20 to 30 minutes.

Quince Jelly. 6lbs. quinces, 5 pints of water, sugar. Wash fruit and cut in small pieces. Put in pan with water and stew slowly, mashing from time to time until fruit becomes tender. Strain through jelly cloth. Boil liquid 20 minutes. Add equal amount of sugar. Boil briskly for 10 minutes. (*Journal of the Dept. of Agri. S. Australia—May 1937.*)

Hybrid Vigour in Plants. Increased vigour over either parent of the product of the cross between two inbred lines has been frequently reported in plant breeding and, through vegetative propagation, efforts have been made, especially with trees, to make practical use of the phenomenon. It is usually explained, in Mendelian terminology, as the result of association of several genes for size which had been isolated in either parent, and subsequent loss of vigour in succeeding generations is attributed to segregation. There has been little analysis, however, of the factors contributing to the heterosis or hybrid vigour during the development of the hybrid, so that considerable interest is attached to recent series of papers by Dr. Eric Ashby which have brought to light some most unexpected features of this process in specific cases.

In certain strains of maize and in two cases with tomato strains where the hybrid showed greater weight and dry weight, greater height, more leaves and larger leaf area than either parent, analysis of these differences showed no appreciable difference between hybrid and parent in relative rates of growth or

of dry weight increase, of rates of production of leaves and new leaf area or of photosynthetic efficiency. Cell size in hybrid and parent also seemed approximately the same, but the embryo of the resting seed seemed larger in all cases.

The only possible conclusion from these results would seem to be that the organization of the growing shoot of the hybrid is upon a larger scale. Embryo and shoot apex form cells more rapidly, but this does not result in a quicker release of leaf primordia from the shoot apex because the whole plan of shoot organization, though still that characteristic of the species, is built upon a larger scale. More cells must accumulate at the apex before the new leaf primordium must separate. Naturally, therefore, when it arises, this primordium is planned on a larger scale from the outset, presumably its procambial and vascular strands are commensurately larger and it grows into a larger leaf, though individual cells in their metabolic and photosynthetic efficiency, correspond with those of the parent forms.

Dr. Ashby speaks of larger primordia in the seed but the term is usually applied to leaf primordia, and in the embryo of the tomato, apart from cotyledons, leaf primordia will scarcely be mainifest yet. It would seem that the comparison is rather upon the scale of organization of the meristematic aggregate in the hybrid shoot; planned on a more generous scale, it yet maintains the rate of leaf development of the parent, so that its growth must mean a larger number of meristematic cells maintained in full activty at any moment, therefore more cell divisions and the growth organization of the species maintained at its usual *tempo* but on a larger scale.

Dr. Ashby's studies are therefore full of significance in relation to the problem of shoot organization in the higher plant, as well as in connexion with the genetic explanation of hybrid vigour. Dr. Ashby points out that his results are not in accordance with the usual interpretation given to the linkage of genes in the F_1 generation, but there is as yet so little information as to the way in which the gene is geared into the machinery of development that it is early to say whether the conventional explanation in terms of genes can be applied to the machinery now revealed as operating in the development of the hybrid. (*Nature —May 15, 1937.*)

Agricultural Jottings.

(The Department of Agriculture, Madras).

Why a Pest Act is necessary for Cambodia Cotton. Cambodia, karunganni and uppam cottons were sown side by side on the Cotton Breeding Station during the year for certain experimental studies. They were picked separately every week. When their weekly pickings were sorted into good and insect damaged kapas, it was found that Cambodia kapas contained 50% more of damaged sort than karunganni and uppam. These have indicated that though karunganni, uppam and Cambodia are sown together, it is the Cambodia variety that suffers most from pests and that the enforcement of the cotton pest act is especially necessary for this variety.

The place of money-crops in the Tanjore Delta. Over a million acres of land are devoted to cultivation of paddy annually in Tanjore District without rotating it with any other crop. Of this area, about 1½ to 2 lakhs of acres are cropped with paddy twice a year while the rest of the area is devoted to a single crop. When prices were ruling high at Rs. 2—8—0 to Rs. 3—0—0 per kalam of 64 lb. there was a decent margin of profit kept for the mirasadars even from a low average yield of 30 kalams per acre. But with the fall in price of paddy ranging from 40 to 60 per cent from 1930 onwards the margin of profit has become very narrow.

Therefore, the immediate problem for the mirasdars was to find out whether there was any possibility of introducing with success other and more profitable crops in wetlands of Tanjore District. Assisted by the departmental crops like sugarcane, plantains and Cambodia cotton were grown.

Sugarcane. The trials conducted with sugarcane of various varieties have definitely established the fact that it is quite possible to grow fairly good crops in paddy fields. Medium soils with fairly adequate irrigation and drainage facilities are preferred. The yields per acre ranged from 25 to 40 tons and it is reckoned that an average of 30 tons per acre could be easily realised under proper cultivation and management. Canes have been introduced in all the taluks of the District. It is also gratifying to record that the mirasdars who were new to this crop, straightaway adopted along with the new cane introduced, up-to-date methods of cultivation such as trench planting etc. This is indeed a distinct gain. Co. 281 and 285 medium canes of the Imperial Cane breeding station, Coimbatore have been found to do very well under ryots' conditions. These varieties have the reputation of withstanding adverse seasonal conditions to a greater extent than the thick canes. They are of short duration, requiring less cultivation expenses capable of withstanding drought and water logged conditions. Good jaggery has been obtained in 8 to 9 months amounting on an average to 6,000 lb. per acre. Further, these varieties are prepared by factories and they readily find favour with Nellikkuppam Factory for sugar manufacture and they are being purchased for this purpose in Shiyali Taluk and its vicinity.

Plantains. Generally plantain in Tanjore District is confined to 'padugai' lands adjoining river banks and it is seldom grown in paddy fields. The introduction and trial crops grown in the paddy lands for the last few years has shown that under proper cultivation fairly good crops can be obtained in paddy fields for three years in the same field. But due to prevalence of cyclonic weather almost every year during north-east monsoon period when bunches appear, the plants have to be propped. It is quite possible to grow plantains in paddy fields of Tanjore as is done in the neighbouring district of Trichinopoly. The cultivation of Mauritius plantains obviates the costly item of propping.

Cambodia Cotton. Trials to grow Cambodia Cotton in between two crops have proved to be of considerable promise. Favourable results have been obtained with the trials conducted in the Agricultural Research Station, Aduturai. Based on this experience, District trials have been laid out in the last season. The results are awaited.

Pineapple—the prospect of the modan lands. The dry lands of the West Coast known as the 'modan' lands in South Malabar are considered to be extremely poor in productivity, and the 'Jenmi' or land-owner gets as rent from this kind of land only 'Vithu-pattam' or just enough paddy equal to the seed used for the area. But a very remunerative crop like pineapple can be successfully grown in modan lands. The profitableness of the crop has given a fillip to the cultivation of this valuable fruit on a plantation scale and the area is steadily on the increase. A net profit of Rs 910 per acre was realised at the Agricultural Research Station, Pattambi during a period of 5 years (the total cost of cultivation for the 5 years including manuring was Rs. 596 and the total receipt was Rs. 1,507). The pineapple cultivation at this station has commenced functioning as a source of supply of fruits, and planting material to the intending cultivators, and shall continue to do so in a larger measure in future.

Pineapple can be grown in all kinds of soils provided there is very good drainage; the laterite soils afford enough aeration and drainage and are found to be the best suited. Propagation is generally from suckers which are of different origin. The 'Ratoons' which spring from below the soil and the suckers arising in the axils of the leaves are to be preferred. Planting is generally started with

the onset of the south west monsoon rains in June—July. It is also done in north—east monsoon periods in September—October, the only point to be borne in mind being the presence of adequate moisture in the soils for the plants to establish. The most popular varieties are the 'Kew' and the 'Mauritius'. Trench planting is the ideal and 10,000 to 12,000 suckers can be planted in an acre. No manure is too rich and an average crop is said to remove 60 lb. of Nitrogen, 212 lb. of Potash and 17 lb. of Phosphate per acre. Enough quantity of manure in the form of cattle manure, wood ash and artificials like Super, Nicifos or Ammonium sulphate to replenish the above quantity would be responded to. Once the crop is established it requires very little attention excepting incorporation of manure, and clean cultivation. The harvest of the crop largely depends on the kind of planting material used, its age, season of planting, soil and the fertilisers used. Suckers and ratoons of optimum size (about 6 months old on the mother plant) would produce fruits from the 15th month onwards after planting. There are two main periods of harvest April to July and October to January, though stray fruits may be available at other times also. The average weight of the 'Kew' fruit is found to be from 5 to 8 lb., the highest weight recorded at the Agricultural Station, being 18 lb. Great care has to be taken in handling the fruit as even slight abrasions are bound to damage the fruit. A plantation once started can be kept going for 5 to 6 years or even more. The plant is thoroughly adapted to xerophytic conditions and is purely rainfed on the West Coast. Organised efforts in marketing will find a ready sale for the fruits.

"**The Coconut Caterpillar.**" *Introduction.* The coconut caterpillar (*Nephantis serinopa*) is one of the major pests of the Coconut palms on the West Coast. The insect has been noticed doing severe damage to coconut fronds during the summer months-February—March to April—May in the taluks of Kurumbranad, Calicut, Ernad and Ponnani in Malabar District and in Mangalore, Ullal and Kasargod in South Kanara District. The pest is not likely to increase in numbers during the monsoon months due to the beneficial activity of the *Eulophid* pupal parasite and also the heavy monsoon showers. The coconut garden owners are, however, warned against the outbreak of the pest during the coming summer months.

Life History of the pest. A short account of the life history and habits of the pest is given below for the use of the garden owners. The pest is a caterpillar about 1½" long striped with pale purple. It feeds on the green matter of the lower surface of the leaves sheltering itself in long galleries constructed out of bits of chewed leaf and pellets of excreta bound together with strands of silk. In severe cases of infestation the leaflets may be reduced to a dry papery tissue. When the caterpillar becomes fullfed it prepares an oval chamber of silk and excreta among the galleries, and turns into a seed like object known as 'pupa'. In about ten days the pupal skin bursts and the moth comes out. The moths are able to fly from tree to tree and garden to garden. They lay eggs about 200 to 300 in number, on the leaves and tiny caterpillars hatch out of the eggs in 4 or 5 days. These feed on the leaves and gradually increase in size. It takes about 1½ to 2 months for each insect to develop from egg to moth.

Methods of control. Coconut palms are too tall to deal with the pest by spraying with insecticides. The only practical method is to cut down infested fronds in a locality at one time and to destroy the caterpillars found thereon by burning the leaves. Since each caterpillar left undestroyed would mean an increase two hundred fold in the next generation the importance of a thorough cleaning is apparent.

An attempt will also be made by the Agricultural Department to breed parasites which attack the pest in different stages with a view to liberate them in affected gardens.

Correspondence.

To The Editor, Madras Agricultural Journal.

Sir,

Mr. S. Gopalakrishnan of Theyagarayanagar in an article about Bee Keeping in the "Gardener," published by Pestonjee P. Pocha and Sons, Volume No. 1st and 3rd, page 33 states about the birth of a queen that when a queen is needed a worker egg or larvae not more than three days old is transferred to an acron shaped cell, specially built for rearing of queen and the chosen larvae is given special feeding with a rich food usually termed "Royal Jelly."

It is an accepted fact that the reigning queen lays an egg in each queen cell specially constructed when a new queen is to be produced, by many authors including Mr. S. Ramachandran of the Department of Agriculture.

Can any one throw light whether the assumption of S. Gopalakrishnan is also correct in the light of his experiences, since it is commonly recognised that laying of eggs by the queen in queen cells for future production of queens is a common occurrence.

4th August 1937. K. M. V.

Reply.

Sir,

The statement made by Mr. Gopalakrishnan in his article on 'Beekeeping' under the heading "The Birth of a New Queen" cannot be accepted as a general rule. The transferring of the eggs or grubs happens only in exceptional cases, where the colony has lost its reigning queen all on a sudden. Under such circumstances, the workers construct queen cells generally round a fertilised egg or a newly hatched grub in the centre of the brood comb itself and rear a queen there. Occasionally, queen cells are also constructed along the lower border of the brood comb and in such cases the transferring of the egg or the grub becomes an obvious necessity.

The general rule is that a queen is reared only from a fertilised egg laid in the queen cell by the reigning queen. Mr. Gopalakrishnan should have stated this first and then made the other statement, if necessary.

Coimbatore, 17--8--1937.

(Sd.) M. C. Cherian,
Government Entomologist.

Crop & Trade Reports.

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1937 to 20th August 1937 amounted to 407,215 bales of 400 lb. lint as against an estimate of 533,100 bales of the total crop of 1936-37. The receipts in the corresponding period of the previous year were 468,295 bales. 289,072 bales mainly of pressed cotton were received at spinning mills and 178,022 bales were exported by sea while 79890 bales were imported by sea mainly from Karachi and Bombay.

(Director of Agriculture).

1937-38--First forecast Report. The average of the areas under cotton in the Madras Presidency during the five years ending 1935-36 has represented 9·5 per cent of the total area under cotton in India.

The area under cotton up to the 25th July 1937 is estimated at 227,000 acres. When compared with the area of 286,300 acres estimated for the corresponding period of last year, it reveals a decrease of 20·7 per cent.

Central Districts and South—Mainly Cambodia tract. The area in the Central districts and the South represents generally the last year's crop left on the ground for second pickings before the plants are removed in September in compliance with the provisions of the Pest Act. The area in these districts fell from 161,200 acres to 161,000 acres. The yield is expected to be generally fair.

Northerns and Westerns tract. The area under Northerns and Westerns fell from 103,000 acres to 46,600 acres, i. e., by 54·8 per cent. owing mainly to the want of timely and sufficient rains.

Cocanadas tract. The area under Cocanadas cotton fell from 15,100 acres to 13,200 acres, i. e, by 12·6 per cent. The decrease in Guntur alone is estimated at 1,000 acres and this is largely due to an increase in the cultivation of groundnut in preference to cotton.

The wholesale price of cotton lint per imperial maund of 82$\frac{2}{7}$ lbs. as reported from important markets on 2nd August 1937 was about Rs. 20—9—0 for Cocanadas, Rs. 21—6—0 for red Northerns, Rs. 19—0—0 for white Northerns, Rs. 18—12—0 for westerns (mungari crop), Rs. 21—7—0 for westerns (Jawari crop), Rs. 27—5—0 for Cambodia, Rs. 27—8—0 for Coimbatore Karunganni, Rs. 21—11—0 for Tinnevellies and Rs. 22—5—0 for Nadam cotton.—(*Director of Industries*).

Sugarcane—1937—38—First report. The average of the areas under sugarcane in the Madras Presidency during the five years ending 1935—36 has represented 3·4 per cent of the total area under sugarcane in India.

The area under sugarcane up to the 25th July 1937 is estimated at 61,620 acres. When compared with the area of 96,950 acres estimated for the corresponding period of last year, it reveals a decrease of 17·5 per cent. The decrease in area is general except in Anantapur, Malabar and South Kanara. The area is estimated to be the same as in the previous year in Anantapur and to have increased slightly in Malabar and South Kanara. The decrease in area elsewhere is generally attributed to the low price of jaggery which prevailed at the time of planting of cane.

The condition of the crop is generally satisfactory.

The wholesale price of jaggery per imperial maund or 82$\frac{2}{7}$ lb. as reported from important markets on 2nd August 1937 was Rs. 5—8—0 in Adoni, Rs. 4—12—0 in Mangalore, Rs. 4—11—0 in Erode, Rs. 4—6—0 in Trichinopoly, Rs. 4—2—0 in Salem and Coimbatore, Rs. 3—12—0 in Cuddalore, Rs. 3—10—0 in Rajahmundry, Rs. 3—5—0 in Vellore, Rs. 2—15—0 in Cocanada, Rs. 2—12—0 in Vizianagaram, Rs. 2—7—0 in Bellary and Rs. 2—6—0 in Vizagapatam. As compared with the prices reported in the corresponding forecast of last year, these prices reveal a fall of 41 per cent in Bellary, 25 per cent in Vizagapatam and Cocanada, 16 per cent in Rajahmundry and Adoni and 9 per cent in Vellore and a rise of 49 per cent in Trichinopoly, 16 per cent in Salem and 7 per cent in Mangalore, the price remaining stationary in Coimbatore.—(*Director of Industries*).

Groundnut—1937—Second Report. *Summer Crop—Area and Yield.* The area under the summer or irrigated crop of groundnut in parts of the Madras Presidency during the five months January to May 1937 is estimated at 67,800 acres. When compared with the area of 61,300 acres estimated for the corresponding period of last year, it reveals an increase of 10·6 per cent. The crop has been harvested in most places. The yield is expected to be normal in all districts

except in Cuddapah and Trichinopoly where it is expected to be below normal on account of insect attack in the former district and to insufficient water supply in the latter. The total yield is estimated at 60,100 tons of unshelled nuts as against 54,900 tons estimated for the corresponding period of last year.

Early Crop—Area and Yield. The area under the early crop of *groundnut* (mostly unirrigated) up to 25th July 1937 in the districts of Salem and Coimbatore is estimated at 181,000 acres. When compared with the area of 128,000 acres estimated for the corresponding period of last year, it reveals an increase of about 41·4 per cent. The condition of the crop is satisfactory. The total yield is estimated at 90,500 tons of unshelled nuts as against 64,000 tons estimated for the corresponding period of last year.

The wholesale price of groundnut shelled per imperial maund of 82$\frac{2}{7}$ lbs. as reported from important markets on 2nd August 1937 was Rs. 6—2—0 in Vizagapatam, Rs. 6 in Cuddalore, Rs. 5—14—0 in Vizianagaram, Rs. 5—13—0 in Guntur, Rs. 5—2—0 in Vellore and Erode, Rs. 4-15-0 in Cuddapah, Rs. 4-13-0 in Adoni and Rs. 4-12-0 in Bellary. As compared with the prices prevailing towards the close of June 1937 published in the last report, these prices reveal a fall of 6 per cent. in Cuddapah, 5 per cent. in Cuddalore, 3 per cent. in Bellary, 2 per cent. in Vizianagaram and Vellore and 1 per cent. in Adoni and a rise of 2 per cent. in Vizagapattam, the prices remaining stationary in Guntur and Erode.—(*Director of Industries*).

Gingelly—1937-38—First report. The average of the areas under gingelly in the *Madras Presidency during the five years ending* 1935-36 has represented 15·2 per cent. of the total area under gingelly in India.

Area. The area under gingelly up to 25th July 1937 is estimated at 356,800 acres. When compared with the area of 344,700 acres estimated for the corresponding period of last year, it reveals an increase of 3·5 per cent. There has been a large increase in area in the central districts and Madura which has been partly counterbalanced by a large decrease in area in the Circars, the Deccan and the districts of Chingleput and South Arcot.

Yield. The yield is expected to be below normal in Vizagapatam, Kistna. Nellore, South Arcot, Trichinopoly and Madura and normal in the other districts.

The wholesale price of gingelly per imperial maund of 82$\frac{2}{7}$ lbs. as reported from important markets on 9th August 1937 was Rs. 6—11—0 in Cuddalore, Rs. 6—7—0 in Ellore, Rs. 6—4—0 in Trichinopoly and Tinnevelly, Rs. 6—3—0 in Tuticorin, Rs. 6—0—0 in Cocanada, Rs. 5—14—0 in Rajahmundry, Rs. 5—12—0 in Salem, Rs. 5—11—0 in Vizianagaram and Rs. 5—4—0 in Vizagapatam.—(*Director of Industries*).

THE MADRAS AGRICULTURAL STUDENTS' UNION

The annual general body meeting of the Union was held on Sunday the 25th July 1937 with Mr. R. C. Broadfoot, Principal and President of the Union in the chair. The minutes of the previous general body meeting, the annual report for the year 1936—1937 and the auditors' report were read and adopted. The budget estimates for the year 1937-38 were discussed and passed.

The following resolutions proposed by Mr. K. Unnikrishna Menon were passed :—

In view of the agricultural graduate being intimate with the actual life of the villager, the Madras Agricultural Students' Union recommends to Government that a proportion of the officers of the Revenue, Co-operative, Labour and Education Departments and Panchayat officers be recruited from among the Agricultural graduates.

As ruralisation of the system of education is an important means of reducing unemployment among the educated classes the attention of the Government be drawn to the desirability of expediting the provision of facilities for the starting of agriculture as an optional or vocational subject in such areas as offer facilities for such provision.

The question of assignment of lands to agricultural graduates and starting of colonies of unemployed graduates was next discussed and the following resolution was passed :—

The Madras Agricultural Students' Union recommends to Government that a special committee including representatives of the Madras Agricultural Students' Union be constituted to go into the question of colonisation of lands by agricultural graduates.

The following office bearers for the year 1937–1938, were elected :—

Council. *Moffusil Vice Presidents*: Mr. K. Unnikrishna Menon, Rao Bahadur G. Jogiraju Garu and Mr. V. T. Subbiah Mudaliar—*Moffusil Members*: Messrs K. Gopalakrishna Raju, A. Chinnathambi Pillai, K. T. Bhandari and A. Chidambaram Pillai and *Resident members*: Rao Bahadur S. Sundararama Ayyar, avl.; Rao Sahib T. V. Rajagopalacharyar avl.; Rao Sahib V. Muthuswami Ayyar avl. and Mr. K. V. Srinivasan (Student).

Managing committee. *Vice President*: Mr. V. Ramanatha Ayyar—*Editor*: Mr. M. U. Vellodi—*Secretary*: Mr. M. A. Sankara Ayyar—*Manager*: Mr. P. A. Venkateswara Ayyar—*Treasurer*: Mr. T. S. Lakshmanan—and *Members*: Messrs. C. S. Krishnaswami, C. Jaganatha Rao, C. Rajasekhara Mudaliar and S. K. Jogi (Student),

Editorial Board. Editor, Secretary, Manager, Dr J. S. Patel and Messrs M. C. Cherian, K. M. Thomas and R. Viswanathan (Student)—

Report of the Managing Committee for the year 1936—37.

(Presented to the General Body.)

The Managing Committee beg to present the following report of the activities of the Union for the year 1936—37.

Membership. The strength of the Union as it stood on 31st May 1937 was 450, including 97 student members. It is noted with regret that nearly two-fifths of the members of the Department are still not members of the Union. We appeal to all of them to join the Union and add to our strength. At the last General Body Meeting the Managing Committee was empowered to extend to such unemployed old boys of the College as require it, the concession rate of subscription applicable to students under the rules. This concession was availed off by eleven old boys.

The Managing Committee. Consequent on his transfer to Adoni, Mr. S. M. Kalyanarama Ayyar resigned his secretaryship in May 1937, and the Managing Committee elected Mr. M. A. Sankara Ayyar as Secretary in his place. Mr. T. S. Lakshmanan was elected as Treasurer and Mr. K. Ramaswami as a member of the Managing Committee. The Committee places on record its appreciation of the wholehearted services rendered by Mr. Kalyanaraman during the time he was Secretary.

Committee Meetings. There were 9 meetings of the Managing Committee during the year.

Journal. The Journal maintained the high standard associated with it. It continued to be printed at The Scholar Press, Palghat. We have great pleasure in recording our grateful thanks to The Editor and the members of the editorial board for the efficient conduct of the Journal. We have alse to record our

appreciation of the promptness and regularity of the printers, The Scholar Press, Palghat.

During the year under review one of the members of the editorial board, Mr. K. Ramiah, left us to take up the appointment of Geneticist at Indore. He is one of the oldest members and an enthusiastic worker in the cause of the Union. We wish him all success in his new sphere of activities.

Subscribers. The number of subscribers (non-members) to the Journal during the year was 200. 25 Journals, Indian and foreign, were on the exchange list. We take this opportunity to appeal to all the members of the Union to actively and materially help the Union by enlisting more subscribers.

Grant of land and money to Agricultural Graduates. At the last General Body Meeting held on the 1st of August 1936, the following resolution was passed: "That this General Body Meeting requests the Director of Agriculture to move government about making statutory provision for the free grant of lands, wherever available and the necessary funds, to agricultural graduates, and that a Committee consisting of M. R. Ry. Rao Sahib V. Muthuswami Ayyar Avl., M. R. Ry. Rao Sahib T. V. Rajagopalachariar Avl., Messrs. G. Jogi Raju, K. Krishnamurthi Rao, G. Mahadevan and the Vice President and Secretary of the Union be formed to prepare an elaborate note as to how the objects could be achieved, for forwarding it with the resolutions to the Government."

The resident members of the sub-committee met and elected M. R. Ry. Rao Sahib Muthuswami Ayyar Avl., as the Convenor of the Committee. Materials for the note are being collected. The task is not an easy one, as a sound case with facts and figures has to be made out.

Finance. The Auditor's Reports and the financial statements are before you. Our finances have shown an improvement over last year inspite of the extra expenditure in connection with the Jubilee celebrations last July and a fairly large amount of arrears in subscription from our members. These dues could not be collected before the end of May owing to changes in the Managing Committee as well as in the permanent establishment. These collections are now in progress.

Ramasastrulu--Munagala Prize. The announcement regarding the Ramasastrulu-Munagala Endowment Prize was made in the April and May numbers of the Journal. We are sorry to note that there was no response and the prize has therefore not been awarded this year.

Establishment. Till towards the end of 1936 the Union was managing its office work with the help of a permanent and an occasional part-time clerk and a peon. A whole time clerk and a boy have now been appointed, thus securing economy and efficiency.

Acknowledgements. We take this opportunity to record our heart-felt thanks to Messrs. R. W. Littlewood and R. C. Broadfoot who as presidents took a keen interest in the affairs of the Union and rendered valuable help, especially in connection with the College Day celebrations. The Union owes a deep debt of gratitude to M. R. Ry. Rao Bahadur D. Ananda Rao Garu for his abiding interest in the activities of the Union. He has been intimately connected with it in the past as Vice-President and President. We learn with regret that he is shortly to retire from active service and we hope that we shall continue to have his help and guidance. We wish him a long, happy and prosperous life. We shall be failing in our duty if we do not record our grateful thanks to the members and convenors of the various committees who whole-heartedly helped us in celebrating the Jubilee last year, especially to Mr. & Mrs. Cherian who organised the tea to the visitors and to Mr. H. Shiva Rau who conducted the sports. Our thanks are also due to Mr, Davis, Principal of the Forest College for loaning to us furniture and tents.

College Day Sports.

The athletic sports in connection with the 26th College Day were held under the auspices of the Madras Agricultural Students' Union on Saturday the 24th July 1937. The College maidan was decked as usual with flags, streamers and buntings. The weather was very favourable till the day previous to the sports but the morning dawned with a clouded sky, and there was slight precipitation too; but fortunately the rain ceased after wetting the ground and imparting to it just that softness which competitors greatly like.

The sports commenced punctually at 3 p. m. and all the items on the programme were completed by 6-10 p. m. There was as usual the keenest competition for ranks and three new records were created, two by Mukundan, in Long Jump and Javelin throw and one by Monappa Hegdé in Cricket ball throw.

Mukundan, by scoring 63 points, was again the champion for the third time in succession. This is the first time in the annals of the College Day sports that a student performs such a feat.

After the events were over Mr. R. C. Broadfoot, Principal and President of the Union, gave a short review of the sports, and requested Mrs. A. C. Woodhouse to distribute the awards. Mr. H. Shiva Rao, the President of the sports committee, proposed a hearty vote of thanks to Mrs. Woodhouse for so graciously accepting our invitation to give away the prizes.

As usual the Union was at home to the ladies and gentlemen who responded to our invitation to witness the sports. Our thanks are due to Mrs. K. M. Thomas for her help in arranging for the 'at home.'

The Union takes this opportunity to record their sincere thanks to Mr. H. Shiva Rao and the other members of the sports committee and all those who gave of their best to make this function a success.

List of Prize Winners.

Cross Country Race (The Norris Cup). 1. T. M. Marthapa Kini. 2. M. Zainulabedeen. 3 T. V. Sailavasadasu.

Hundred Yards Dash (The Saidapet Old Boys' Cup). 1. M. Mukundan. 2. S. V. Joseph Doss. 3. K. M. Aiyappa.

Long Jump. 1. M. Mukundan 2 M. Ramiah. 3. K. M. Aiyappa.

Shot Put. 1. M. Mukundan. 2. P. K. S. Mani. 3. Mohan Punja.

High Jump (Rao Bahudur C. Tadulingam Cup). 1 M. Mukundan. 2. P. K. S. Mani. 3. M. Ramiah.

Quarter Mile Race (The Prince of Wales Cup). 1. T. M. Kini. 2. M. Mukundan. 3. N. J. Sreshta.

Cricket Ball Throw. 1. Monappa Hegde. 2. M. Mukundan. 3. K. Santhanam.

Half Mile Race. 1. T. M. Kini. 2. Zainulabedeen. 3. N. V. Srinivasan.

Javelin Throw. 1. M. Mukundan. 2. K. Santhanam. 3. P. K. S. Mani.

Half Mile Race (Invitation). 1. P. Nagaswami (Central Recruits School). 2. Dominic (Government College High School).

120 Yds. Hurdles (The Rao Bahudur Ramaswami Sivan Cup). 1. T. M. Kini. 2. M. Ramaiah. 3. M. Mukundan.

Old Boys' Race (100 Yds. Handicap). 1. A. M. Kulandai. 2 S. Varadarajan.

1 Mile Race (The Anstead Cup). 1. T. M. Kini. 2 Zainulabedeen. 3. Sreshta.

Inter-Tutorial Relay Race (The Chunampet Shield). Mr. Lakshmipathy's wards,

Obstacle Race. 1. P. K. S. Mani. 2. T. P. S. Nainar. 3. P. S. Srinivasan.

Inter-Tutorial Tug-of-War (The Ramanad Shield). Dr. J. S. Patel's Wards.

Pole Vault. N. V. Srinivasan.

Championship (Vengail Krishnan Nayanar's Cup). M. Mukundan.

College News & Notes.

Students' Corner. On 14—7—37 the students of the 2nd and 3rd year classes gave a welcome tea to the 1st year and short course students. The members of the teaching staff, the tutors, etc., took part in the function. The representatives of the 2nd and 3rd year students welcomed the freshers. The representative of the 1st year students thanked the senior students.

A portrait of Mr. G. Krishnaswami Mudaliar, G. M. V. C., who was Lecturer in Animal Hygiene at the College and retired from service recently, was presented by his students to the College and was unveiled on the occasion by Mr. R. C. Broadfoot, the Principal.

Games. After a temporary lull due to the College Day celebrations all the games are in full swing. Cricket in particular has become increasingly popular due to the presence of Mr. C. Ramaswami, the Indian Test cricketer, who is now posted to Coimbatore and is residing on the College estate.

College Day Cricket Match. The usual match between officers and students was played on the 25th July. Great interest was centred round the game due to the inclusion of Mr. Ramaswami in the officers' team. The officers batted first and declared at 163 for 9, thanks to a great innings by Mr. Ramaswami, who was unbeaten with 110 to his credit. For the students the bowling honours were shared by Dinker Rao (4 for 41), Kothandaraman (2 for 35) and Mahabala Shetty (2 for 12). The students started their innings disastrously losing 3 wickets for 9 runs but a determined stand between Kothandaraman and Dinker Rao raised the score to 49 before they were separated. When stumps were drawn the students had made 78 runs for 7 wickets. Dinker Rao's contribution was 38 runs and Kothandaraman's 22. For the officers, Ramaswami took 3 wickets for 14 runs, Vasudevan 2 for 21 and Varadarajan 1 for 8.

League Cricket. Two matches were played in connection with the Y. M. C. A. Cricket Tournament for the Rhondy Shield. The first was against the Government College and played on the Agricultural grounds. The visitors batted first and made 111 runs, the chief run getters being Padbhanabhan (28), Subramaniyam (22) and Srinivasan (21). For the home team Dinker Rao excelled in bowling and took 7 wickets conceding only 24 runs. Other bowlers did not strike form. Our college replied with 119 runs. The finish was very exciting as our team had made only 80 runs for 5 wickets but two more wickets fell at 93 and the 8th and 9th wickets were down at 98 and 99 runs respectively. Mukundan played a very plucky innings and placed the issue beyond doubt by hitting two boundaries in succession.

The second match of the tournament was against the Stanes High School Our team was considerably strengthened by the addition of Mr. C. Ramaswami. The school scored 55 runs to which Keir and Bird contributed 15 and 13 runs respectively. The bowling honours were even. Mukundan took 3 wickets for 15 runs, Dinker Rao and Kothandaraman took 2 each for 12 and 22 runs respectively. Varadarajan claimed 1 for 3 runs. The college replied with 236 runs. Ramaswami made 59, Kothandaraman 36, Mahabhala Shetty 35 (retired), Mukundan 24, Varadarajan and Babu 22 each and Shiva Rao 12. In their second venture, the school team made 93 runs for 4 wickets. The college thus won the match comfortably.

Football. A match was played on 28—7—37 between the officers and the students. The students outpaced the officers and won by 4 goals to 1. On 5-8-37 a friendly match was played against the Government College. The Government College won by 2 goals to nil.

Abraham Memorial Football Tournament. The first game in connection with the Abraham Memorial Tournament was played against the P. S. G. Industrial Institute on 9—8—37. Our college won by 3 goals to nil. The second match was against the Municipal High School on 13--8—37. Our team scored first but the equalizer came in the second half. Extra time was allowed and the Municipal High School took the lead by scoring an extra goal.

Agricultural College students to the rescue of villagers. On Friday, the 30th July 37, when the final year students were returning after a village enquiry in Peelamedu, they observed fire breaking out in a small hamlet. Immediately, led by Mr. V. Suryanarayana, Assistant Lecturer in Agriculture, they set about bringing the fire under control; with the arrival of the Municipal fire engine the fire was put out without any appreciable loss of property. The villagers thanked the students for their timely help.

The Fieldmen's Association of the Madras Agricultural Department. A general body meeting of the association was held on the 4th August 1937 with M. R. Ry. Rao Bahadur G. N. Rangaswami Ayyangar Avl., in the chair. The following office bearers were elected for 1937—38: Mr. S. Gnanaprakasam Pillai, President, Mr. K. Raghavan, Secretary, Mr. C. K. Kuppamuthu Pillai, Assistant Secretary and Treasurer, and Messrs. D. Devasirvatham, C. S. Narayanaswami, V. Narayana Ayyar and C. R. Venkataraman, Committee Members.

The Association of Economic Biologists. Under the auspices of the association Mr. Le Pelly, Entomologist, Kenya, delivered an interesting lecture on "Agricultural conditions in Kenya with special reference to insect pests" on Monday the 17th August 1937.

Weather Review—JUNE 1937.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	2·9	-2·9	15·0
	Calingapatam	2·9	-1·8	9·9
	Vizagapatam	2·1	-2·8	10·0
	Anakapalli *	2·6	-2·5	14·8
	Samalkota*	1·2	-3·6	10·6
	Maruteru *	1·2	-2·4	5 6
	Cocanada	3·7	-0·8	10·9
	Masulipatam	1·4	-3·1	6·8
	Guntur*	0·7	-2·8	4·5
Ceded Dists.	Kurnool	1·5	-1·4	5·9
	Nandyal*	3·7	-1·0	10·8
	Hagari *	0·2	-2·0	4·5
	Bellary	...	-1·9	5·8
	Anantapur	3·8	+1·8	10·1
	Rentachintala	5·6	...	12·4
	Cuddapah	2·0	-0·9	7·3
	Anantharajupet *	1·1	-2·8	5·7
Carnatic	Nellore	0·6	-0·7	30·5
	Madras	1·7	-0·2	4·4
	Palur *	0·1	-1·8	4·2
	Tindivanam *	0·3	-1·9	3·7
	Cuddalore	0·3	-1·3	3·9
Central	Vellore	3·6	+1·3	8·7
	Salem	4·6	+1·5	10·1
	Hosur*	2 09	-0·8	17·36
	Coimbatore	0·3	-1·4	7·1
	Coimbatore A. C. & R. I.*	0·2	-1·2	10·0
	Trichinopoly	1·0	-0·4	10·8

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	...	-1·3	8·9
	Aduthurai *	1·80	+0·5	6·0
	Madura	0·20	-1·2	2·5
	Pamban	...	-0·1	10·8
	Koilpatti	0·1	-0·4	7·7
	Palamkottah	...	-0·6	6·8
West Coast	Trivandrum	6·0	-7·4	22·7
	Cochin	23·7	-4·8	39·1
	Calicut	23·7	-10·4	34·4
	Pattambi *	18·0	-6·4	25·3
	Taliparamba *	...	...	...
	Kasargode *	36·7	-1·7	47·9
	Nileshwar*	28·6	-13·2	36·2
	Mangalore	34·5	-2·3	41·9
Mysore and Coorg	Chitaldrug	0·8	-2·0	3·6
	Bangalore	3·0	+0·2	16 5
	Mysore	1·6	-1·3	16·9
	Mercara	17·1	-5·2	28·7
Hills	Kodaikanal	3·3	-0·8	22·1
	Coonoor	3·5	...	28·3
	Ootacamund *	4·1	-1·0	20·3
	Nanjanad *	3·9	-4·2	15·8

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in Fort St. George Gazette.

The Bay of Bengal branch of the monsoon which was active in the neighbourhood of Ceylon and in the south and central Bay in the beginning of the first week became active and strong later, and caused widespread thunder rains in north east India. The Arabian Sea branch of the monsoon, which made a feeble advance in the beginning of the first week on the Malabar Coast, became established during the second week and remained active till the end of the month in Malabar, Kanara and Konkan.

Fairly widespread thundershowers have occurred in South Deccan, Mysore, South Madras Coast, North Madras Coast, Malabar, Konkan, and in the interior of the Peninsula, during the second and third week of the month.

Rainfall was in large defect throughout the Peninsula and markedly so in the Circars, the Ceded Districts and the West Coast.

The chief falls reported were:—

Kasargode	5·05″
Cochin	5″ (on 3rd June).

Weather Report of the Research Institute Observatory.

Report No. 6/37.

Absolute maximum in shade ...	... 95° F.
Absolute minimum in shade ...	... 71·0°F.
Mean maximum in shade ...	... 89·2°F.
Departure from normal ...	... Nil.
Mean minimum in shade ...	... 75·8°F
Departure from normal ...	... +2·7°F
Total rainfall for the month ...	... 0·24"
Departure from normal ...	... -1·1"
Heaviest fall in 24 hours ...	... 0·08"
Total number of rainy days ...	... 2 days.
Mean daily wind velocity ...	... 6·0 m. p. h.
Mean humidity at 8 hours ...	... 68·5%
Departure from normal ...	... -0·8%

Summary. Rainfall was in large defect. The appearance of the monsoon was noticed in the beginning of the month but was not active. The mean minimum was in excess by 2·7°F while the mean maximum and humidity were about the normal. Skies were heavily clouded. P. V. R. & P. G.

JULY 1937.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	7·6	+0·7	22·6
	Calingapatam	4·9	-0·4	14·8
	Vizagapatam	1·5	-3·0	11·5
	Anakapalli*	5·0	-0·4	19·8
	Samalkota*	5·5	-1·8	16·1
	Maruteru*	4·2	-4·5	9 9
	Cocanada	6·3	+0·5	17·2
	Masulipatam	7·1	+0·7	13·9
	Guntur*	9·2	+3·4	13·6
Ceded Dists.	Kurnool	6·2	+1·4	12·1
	Nandyal*	7·5	+2·1	18·2
	Hagari*	1·1	-1·1	5·6
	Bellary	1·5	-0·4	7·3
	Anantapur	1·7	-1·7	11·8
	Rentachintala	4·9	...	17·3
	Cuddapah	2·5	-1·4	9·8
	Anantharajupet*	6·6	+4·3	13·3
Carnatic	Nellore	3·1	+0·3	33·6
	Madras	3·6	-0·3	8·0
	Palur*	2 5	-0·1	6·8
	Tindivanam*	1·7	Nil	5·3
	Cuddalore	2·2	-0 9	6·1
Central	Vellore	1·9	-3·4	10·6
	Salem	1·7	-2·1	11·8
	Hosur*	1·9	-0·9	19·3
	Coimbatore	1·0	-0·5	8·1
	Coimbatore A. C. & R. I.*	1·5	+0·2	11·5
	Trichinopoly	0·7	-0 9	11·5

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	0·8	-1·1	9·7
	Aduthurai*	0·3	-1·1	6·2
	Madura	Nil.	-1·9	2·5
	Pamban	0·2	-0·4	11·0
	Koilpatti	0·1	-0·6	7·8
	Palamkottah	0·1	-0·3	6 9
West Coast	Trivandrum	11·0	+3·6	33·7
	Cochin	45·0	+22·2	84·1
	Calicut	59·0	+28·8	93·4
	Pattambi*	32·3	+7·5	57·6
	Taliparamba*	...	...	...
	Kasargode*	78·0	+39·6	126 0
	Nileshwar*	78·4	+37·8	114·6
	Mangalore	65·6	+28·5	107·5
Mysore and Coorg	Chitaldrug	2·3	-0·7	5·9
	Bangalore	3·7	-0·4	20·2
	Mysore	2·1	-0·4	19·0
	Mercara	57·7	+16·8	86·4
Hills	Kodaikanal	3·4	-1·6	25·5
	Coonoor	3·4	...	31·7
	Ootacamund*	8·5	+2·7	28·8
	Nanjanad*	9·5	-1·7	25·3

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in Fort St. George Gazette.

Both the Arabian Sea and the Bay of Bengal branches of the monsoon were generally active throughout the month.

The monsoon was vigorous in Malabar, North Madras coast and South East Madras. Thunder showers occurred during the second week of the month at many places in the central part of the country.

On the 2nd, conditions became unsettled in the north-west angle of the Bay of Bengal, became less marked on the 3rd, and disappeared the next day,

A depression formed on the 11th off Puri. This depression moved on to Raipur and took a northerly course and then a north-westerly direction and filled up over Kotak on the 16th. This depression caused heavy rainfall along its track.

A third depression of the Bay of Bengal formed on the 22nd and moving in a north-westerly direction crossed the coast near Chandbali and Balasore on the 24th lay as a deep depression over the Central Provinces on the 25th and filled up on the 27th after causing heavy rainfall along its track.

The rainfall was markedly above normal in the West Coast and the Hills. It was in moderate excess in parts of the Ceded Districts and was below normal in the Central and Southern districts.

The chief falls recorded were :—

Mangalore	5·50″	on the	2nd.
Mercara	5·30″	„	12th.
Kasargod	6·95″	„	„
Nileshwar	8·38″	„	„
Calicut	10·00″	„	18th.

The maximum temperatures were below normal in most places and normal in others; the highest temperature recorded being 102°F at Madura, Nellore, Cuddalore and Rentachintala.

Weather Report of the Research Institute Observatory.

Report No. 7/37.

Absolute maximum in shade ...	90·8°F.
Absolute minimum in shade ...	68·5°F.
Mean maximum in shade ...	85·3°F.
Departure from normal	– 1·8°F.
Mean minimum in shade	74·6°F.
Departure from normal	+2·6°F.
Total rainfall for the month ...	1·47″
Departure from normal	+0·2″
Heaviest fall in 24 hours	0·6″ recorded on 22nd.
Total number of rainy days ...	5
Mean daily wind velocity	5·4 m. p. h.
Mean humidity at 8 hours	72%
Departure from normal	+0·6%

Summary. The monsoon was generally active. The rainfall recorded was slightly in excess of the normal. The heaviest rainfall was recorded on the 22nd. The skies were heavily clouded and the mean humidity was slightly above the normal. The mean maximum temperature was below normal by 1·8°F while the mean minimum was 2·6°F above the normal. P. V. R. & F. L. D.

Departmental Notifications.

1. Promotions.

Mr. C. S. Namasivayam Pillai Avl., Lower subordinate, from V grade to IV grade with effect from 16th Septembar 1936.

2. Transfers.

Name of Officers.	Transferred	
	From	To
Mr. R. Vasudeva Rao	F. M. Samalkota	A. D. Madras.
" T. Rangabrahma Rao	A. R. S. Samalkota	A. D. Tanuku.
" K. V. Chalpati Rao	A. D. Kovvur	A. D. Tanuku.
" P. P. Syed Muhammad	A. D. Co. 2 Scheme	To Chemistry section.
" G. Doriswami Naidu	A. D. Co. 2 Scheme	F. M. Sriuguppa.
" P. N. Muthuswami	A. D. Harur	A. D. VI Circle.
" C. S. Sankaranarayana Iyer	F. M. Nanjanad	A. D. Coimbatore.
" B. G. Narayana Menon	A. D. Coimbatore	F. M. Nanjanad.
" G. V. Narayana	Oilseeds Section, Coimbatore.	A. R. S. Kasaragod.
" M. M. Krishna Marar	F. M. Kasaragod	Oilseeds Section, Coimbatore.
" P. Kannan Nambiar	A. D Salem	A. D. Cannanore.
" K. Govindan Nambiar	A. D. Cannanore	F. M. Taliparamba.
" E. Kunhappa Nambiar	F. M. Taliparamba	A. D. Tellicherry.
" P. A. Narayanan Nambiar	A. D. (on leave)	F. M. Taliparamba.
" T. Krishna Reddy	A. D. Dhone	A. D. Koilkuntla.
" Y. Venkataswami	A. D. Koilkuntla	A. D. Dhone.
" A. Krishnaswami Iyer	A. D. Kurnool	A. D. Kodaikanal.
" K. Narayanan Nair	A. D. Co. 2 Scheme	A. D. Namakkal.

3. Leave.

Name of officers.	Period of leave.
Mr. Y. V. Narayanaiah, Asst. Chemistry Section.	l. a. p. from 5th August to 2nd October '37.
" P. Gopalakrishnan, Asst. Chemistry Section.	l. a. p. from 5th August to 3rd October '37.
" A. Subramaniam, A. D. Narasipatam.	extension of l. a. p. for 3 months.
" E. K. Govindan Nambiar, F. M. Taliparamba.	l. a. p. for one month from 9th August '37.
" N. Ramadoss, A. D. Srungavarapukota.	Extension of l. a. p. on m. c. for one and half months from 1st August '37.
" S. Dharmalingam Mudaliar, Asst. Paddy Section.	l. a. p. for one month from 11th August '37.
" M. Subba Reddy, F. M. Kodur.	Extension of l. a. p. for one and a half months on m. c. from 15th August '37.

ADDITIONS TO THE LIBRARY DURING JULY 1937.

A. Books:

1. The Nature and Properties of Soils. *Lyon T. L. and Buckman H. O.* (1937). 2. Conservation of the Soil. *Gustafson A. F.* (1937). 3. Land Reclamation in Italy: Rural Revival in the Building of a Nation Tr. by O. R. Agresti. *Longobardi C.* (1936). 4. Soil Conservation—Bibliography Revised by J. Henderson. *Wieland L. H* (1936) 5. Moisture and Farming in South Africa. *Thompson W. R.* (1936). 6. Profit from Fertilizers. *Long H. C.* Ed. (1936). 7. Rose Craft: A Guide to Rose Growing. *Day H. A.* (1937). 8. South African Garden Manual. *Day H. A.* (1936). 9. Pests of Fruits and Hops. *Massee A. M.* (1937). 10. Woolly Aphis Control. *Greenslade R. M.* (1936). 11. The Biological Control of Insects. *Sweetman H. L.* (1936). 12. Introduction to Research on Plant Diseases. *Riker A. J. & Riker R. S* (1936). 13. Laboratory Outline in Filterable Viruses. *Hyde R. R.* (1937). 14. Sheep Farming. *Fraser A.* (1937). 15. Beekeeping in South Africa. *Attridge A. J.* (1933). 16. Fruit Markets in Eastern Asia. (California A. E. S. Bull. 493). *Crocheron B. H. & Norton W. J.* (1930). 17. The Freezing Preservation of Fruits, Fruit Juices and Vegetables. *Tressler D. K. & Evers C. F.* (1936). 18. Food Industries Manual. *Tressler D. K & Evers C. F.* (1937). 19. The Technique of Marketing Research. *Wheeler F. C.* (1937). 20. Agricultural Prices. *Thomsen F. L* (1936). 21. Sidgwick's Organic Chemistry of Nitrogen. *Taylor Rev. T. W. J. & Baker W.* (1937). 22. Fundamentals of Bacteriology. *Frobisher M.* (1937). 23. Proceedings of Conference on Statistical Methods of Sampling Agricultural Data. (*U. S. Agri. Dep. Bur. Agri. Econ. Pub.*) *Frobisher M.* (1936). 24. Panchayats in India. *Drummond J. G.* (1937).

B. Reports:

1. Travancore Agricultural & Fisheries Department Administration Report for 1111 M. E. (1936). 2. Report on the Administration of the Agricultural Department in the Cochin State for the Year 1111 (1935—36). 3. Annual Report of the Department of Horticulture Mysore State for the Year 1934—35. 4. Annual Report of the Department of Agriculture in the Bombay Presidency, 1935—36. 5. Annual Report of the Department of Agriculture, Gwalior Government for the Year 1935--36. 6. Summary of Proceedings of the Thirty-third Meeting of the Indian Central Cotton Committee, Bombay, held on the 17th & 18th August, 1936. 7. Annual Report of Tea Research Institute of Ceylon for the Year 1936. 8. East Malling Research Station Annual Report for 1936. 9. Report of Oklahoma A. & M. College Agricultural Experiment Station for 1934—1936.

C. Special Publications:

10. The Silviculture and Management of the Bamboo. (*Indian Forest Records N. S. Silvi. Vol. II, No. 4*). 11. Report of the Motor Vehicles Insurance Committee 1936—37. 12. A Guide to Indian Cottons. (*East India Cotton Association Pub.*), 13. Proceedings of the Second Dearborn Conference of Agriculture, Industry and Science. 14. Bibliography on Soil Conservation. (*U. S. Agri. Dep. Soil Conser. Ser. Pub.*). 15. Proceedings of Conference on Statistical Methods of Sampling Agricultural Data. (*U. S. Agri. Bur. of Agri. Econ. Pub.*). 16. Survey of the Oil Content and Iodine Value of Western Canadian Flaxseed. 1936 Crop. (*Grain Res. Lab. of Canada Pub.*). 17. Rainfall Characteristics and Their Relation to Soils and Run-off. (*American Society of Civil Engineers Pub.*). 18. Soil Erosion in Iowa. 19. Orange County Lemon Production Cost Analysis. 1936. (*California Agri. Extn. Ser. Pub.*). 20. Orange Country Valencia Production Cost Analysis. 1936. (*California Agri. Extn. Ser. Pub.*).

D. Bulletins, Memoirs Etc.:

21. Further Tests on Indian Cottons with Different Systems of High Draft Spinning. *Ind. Cen. Cot. Com. Tech. Bul. Ser. A. 37.* 22. The Soils of the Rice Areas of the Gujranwala and Sheikhpura Divisions of the Upper Chenab Canal. *Punjab Irrigation Res. Inst. Res. Pub. Vol. III, No. 2.* 23. A Study of the Soil Profiles of the Punjab Plains with reference to their Natural Flora. *Punjab Irrigation Res. Inst. Res. Pub. Vol. III, No. 3.* 24. Crop Production in Frames. *Eng. Min. Agri. Bul. 65.* 25. Cider Apple Production. *Eng. Min. Agri. Bul. 104.* 26. Manuring of Fruit Crops. *Eng. Min. Agri. Bul. 107.* 27. Studies in Tropical Fruits. *Trinidad Imp. Col. of Trop. Agri. Mem. 4.* 28. (a) Citrus Wastage Investigations. *Union of S. Africa Agri. & For. Bul. 167.* (b) Report on an Economic Investigation into Farming in four Maize Districts of the Orange Free State 1928—30. *Union of S. Africa Agri. & For. Bul. 173.* 29. Report on a Visit to Northeru Nigeria to study Mixed Farming. *Gold Coast Agri. Dep. Bul. 33.* 30. Tankage Its Value in Livestock and Poultry Feeding. *Dom. Canada Agri. Dep. Pub. 558.* 31. Investigations on the Occurrence and Inheritance of the Grass Clump Character in Crosses Between Varieties of Triticum vulgare. *Com. of Australia Coun for Sci. & Ind. Res. Bul. 104.* 32. Methods of Wheat Breeding in China: Hybridization *China National Agri. Res. Bur. Min. of Ind. Spl. Pub. 19.* 33. Plantation Operations of Landlords and Tenants in Arkansas. *Arkansas Agri. Exp. Stn. Bull. 339.* 34. Lysimeter Experiments—IV—Records for Tanks 17 to 24 during the years 1922 to 1933, and for tanks 13 to 16 during the years 1913 to 1928. *Cornell A. E. S Mem. 194.* 35. Physiological Studies on Rhizobium Species. *Cornell A. E. S. Mem. 196.* 36. Soil and Plant Response to Certain Methods of Potato Cultivation. *Cornell A. E. S. Bul. 662.* 37. Influence of Storage Temperature and Humidity on Seed Value of Potatoes. *Cornell A. E. S. Bul. 663.* 38. Effect of Soil Reaction on Growth, Yield, and Market Quality of Potatoes. *Cornell A. E. S. Bul. 664.* 39. Orchard Terracing. *Clemson A. E. S. Bul. 97.* 40. Safe Drinking water. *Michigan A. Ext. Dvn. Bul. 173.* 41. The Nitrate Nitrogen in the Soil as Influenced by the Crop and the Soil Treatments. *Missouri A. E. S. Res. Bul. 250.* 42. Raising the Dairy Calf. *Missouri A. E. S. Res. Bul. 377.* 43. Acquiring Farm Ownership by Payments in Kind. *Missouri A. E. S. Res. Bul 378.* 44. Determining the Tonnage of Hay in Long Stacks and Round Stacks. *Neveda Agri. Exp. Stn. Bul. 143.* 45. Analysis of the Business Operations of Cooperative Cotton Gins in Oklahoma, 1933—34. *Washington Farm Credit Adm. Bul. 12.* 46. Protection of Apples and Pears in Transit from the Pacific Northwest during the Winter Months. *U. S. Agri. Dep. Tech. Bul. 550.* 47. Soil and Water Conservation Investigations. *U. S. Agri. Dep. Tech. Bul. 558.* 48. Influence of Packing and Handling Methods on Condition of Apples Barreled for Export. *U. S. Agri. Dep. Tech. Bul. 559.* 49. The Effectiveness of Cultivation as a Control for the Corn Earworm. *U. S. Agri. Dep. Tech. Bul. 561.* 50. The Effect of Exposure in the Field on Grade, Strength, and Color of Raw Cotton. *Texas Agri. Exp Stn. Bul. 538.* 51. The Tennessee Poultry House. *Tennessee Agri. Extn. Ser. Pub. 132.*

E. Circulars, Leaflets Etc.

52. Prevention of Virus Diseases of Greenhouse Grown Tomatoes. *Dom. of Canada Agri. Dep. Cir. 118.* 53. Prevention of Tobacco Mosaic in Ontario. *Dom. of Canada Agri. Dep. Cir. 119.* 54. Distribution of the Varieties and Classes of Wheat in the U. S. in 1934. *U. S. Agri. Dep. Cir. 424.* 55. Organization and Operation of Cooperative Irrigation Companies. *Washington Farm Credit Adm. Cir. 102.* 56. Home Drying of Vegetables and Fruits. *Utah Agri. Col. Ext. Ser. Cir. 87.*

Rao Bahadur D. Ananda Rao Garu, B. Sc. (Edin.), I. A. S.

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Editorial.

Our Retiring Director of Agriculture. On the 15th of September M. R. Ry. Rao Bahadur D. Ananda Rao Garu, laid down the reins of office as the Director of Agriculture, Madras, after nearly 28 years of untiring service to the cause of Agriculture in Madras.

He has the unique distinction of being the first old student of the Madras Agricultural College to become a Director of Agriculture. After undergoing preliminary training in the Saidapet College of Agriculture, Mr. Ananda Rao went to Edinburgh. On his return to India he joined the Department as Assistant Director of Agriculture in 1908 and served the northern districts in that capacity till 1914 when he made a special study of the paddy seed beds in the Kistna Delta.

For the next seven years he was at Coimbatore as Assistant Principal, Professor of Agriculture and Superintendent of Central Farm. During these years he organised the College Dairy to a high level of efficiency. He made a study of the daily variation in the composition of milk and of the influence of different kinds of fodders, on the quantity and quality of milk. He further investigated the condition of dairy industry round about Coimbatore and the economics of *ghee* trade. The efficiency of labour and the economics of small holdings were also the subjects of his enquiry.

In 1921 as a fitting recognition of his valuable services he was promoted to the Indian Agricultural Service and a year after he was transferred to St. Thomas Mount as the Deputy Director of Agriculture of the Fourth Circle. During the period of eight years in which he was associated with the districts of North and South Arcot, Chittoor and Chingleput he did much of poineer work especially on groundnut and sugarcane. His experiments on the rotation and manuring of crops and mixed cultivation at Palur are an indication of his intense agronomic outlook. He was the first in the Department to realise the necessity for a separate farm for groundnut research and the first groundnut research station was fortunately organized and opened by him.

In 1926 Mr. Ananda Rao went on leave to the Continent, and even during this period he studied rice culture in Italy so that the benefits of the experience of the Italian agriculturists might be readily available to his country. In 1928 the title of Rao Bahadur was conferred on him. In 1929 the post of Head-quarters Deputy Director was sanctioned, and Mr. Ananda Rao was selected for this post as the best fitted man for assisting the Director of Agriculture in giving a fresh stimulus to the propaganda activity of the Department. Even though the urge to get into intimate contact with the agriculturist and his live material would have been alive in his heart he responded to the call of duty magnificently and carried on the administrative tasks of that post which to most of us would be irksome.

In 1934 when he was posted as the permanent Principal of the Agricultural College at Coimbatore he immediately set about devicing ways and means which would enable the students to ultimately become efficient agriculturists. Both as a Professor of Agriculture and as a Principal he was loved by his students.

In June 1935 he became permanent Director of Agriculture. And under his very able guidance the Department has been forging ahead in many directions. It was his ceaseless effort that resulted in the appointment of store keepers who relieved the Agricultural Demonstrators from their routine work and made them more available for their legitimate propaganda activities. Realising the possibilities of harnessing the press for Departmental propaganda he has brought into vogue the system of publishing agricultural jottings with which every reader of English and Vernacular dailies of Madras is now so familiar. During his tenure of office the policy of imparting practical training in agriculture to educated young men coming from the land-owning classes was initiated.

He has been one of the founders of the Madras Agricultural Students' Union and held the offices of Vice-President and President. His personal interest in the Union remains as keen as ever.

Being a hard and sincere worker himself he expected a high standard of work from his subordinates; nevertheless he was extremely kind and sympathetic. Mr. Ananda Rao is still of a very active disposition and we trust that his accumulated knowledge and varied experience will be available to the Province in spite of his retirement.

A worthy partner in life has been Mrs. Ananda Rao, whose genial personality and sympathetic heart have been admired by one and all.

We wish them a very long and happy life.

RURAL RECONSTRUCTION—SOME SUGGESTIONS

BY

Dr. B. V. NARAYANASWAMI NAIDU, M.A., B. Com., Ph. D., Bar-at-Law.

India being predominently an agricultural country, any attempt at rural reconstruction must aim at strengthening and developing our premier national industry namely agriculture. This paper has in the main kept in view this aspect of the rural problem and suggestions have been made to improve agriculture and with it the lot of our peasants in the country side.

Even the most casual student of Indian Economics cannot but perceive a very great shift of emphasis in national attention from the problems of the city to the conditions of the country side. The Village Industries Association of Mr. Gandhi, the Congress manifesto and the ministerial programmes in U. P., Bengal, Bombay and Madras have all laid stress on the amelioration of the conditions of the Indian peasant. Attention to the sufferings of the peasant has been called by intensive rural propaganda, by *Kisan* movements and peasant marches. It cannot be doubted that the peasant in this country has been starving for decades and yet this many-sided solicitude strikes one as rather new; but then arises the consoling thought that it is never too late to begin a good thing. Public opinion has rightly called attention to the importance of the problem which affects the destinies of the Indian agriculturists who form roughly $\frac{1}{7}$ of the world's population. Relief to their sufferings, and removal of their hunger, ignorance and sickness, are not merely humanitarian actions; but they are calculated to change the economic organisation of the whole of India and even of the world. One yard of cloth more worn by the Indian peasant means prosperity to mills not merely in India but also in England and other countries. The more we think of the question the more we wonder how agriculture which is at the root of all human activity could be neglected by the Government and leaders of opinion. Even in the most highly mechanised countries like Russia, England and America, the growing need for agricultural stability is recognised. The recent policy of the British government towards agriculture, the first 'Ten Year Plan' in Russia and some of the aspects of Roosevelt's 'New Deal,' all bear testimony to the key position occupied by agriculture in the national economy of the countries concerned.

Before the eye of this newly awakened interest how does the Indian peasant stand? Oppressed by poverty, ignorance and hunger, toiling under the heavy hand of slow moving tradition, the patient Indian peasant labours on with his primitive implements, pursuing age old methods, binding himself to the microscopic holdings which are too small for a good living but too big to be given up in the midst of

the gloom and uncertainty that surrounds him. The most optimistic of calculations puts down his income at Rs. 42/- per year. Groaning under a heavy load of debt exposed to the tender mercies of the monsoon on which he depends for water (only 16% of the agricultural land being irrigated artificially) with few credit or marketing facilities he sells almost always at unfavourable times and meets a heavy tax burden. Indian agricultural conditions do not admit of corporate organisation and little wonder then, that neglected and depressed in this way, agriculture in India does not attract the best brains of the land. A recent English writer in the *New Review* observes thus of the Indian peasant:

> " He has become the slave of the soil and of custom, of the heat and of the rain, of money and money-lenders ; the victim of land-laws and landlords, of a hundred agencies that have cramped his initiative, shrivelled up his individuality and isolated him in misery and despair. He has lost his grip on the land, his grit in work ; he is no more the soul of the country side. The rallying cry should be not 'man back to the land,' but 'the land, back to man.'

By a very easy and natural transition this picture leads us to the thought that such a state of things cannot continue for long and that strenuous efforts both by the people and the Government, are necessary to bring about a new order. I am very far from suggesting that absolutely no efforts have been made by Government in regard to this vital matter. For more than a decade and a half now, Government have tried to tackle the various problems connected with the life and labour of the millions in our villages. Schools have been built, wells sunk, hospitals established, co-operative societies started, agricultural demonstrations held, veterinary doctors sent out, 'sanitation attended to, temperance preached, and roads and communications improved; and yet we have the disquieting feeling that we have only touched the fringe of the problem and that perhaps we have neither directed our energies along the most beneficial channels nor expended our funds to the maximum advantage of our people. The need of the hour seems to be greater, and more sustained effort, better co-ordination and an orientation of our endeavour along well-planned lines towards a definite goal.

Let not the words 'plan' and 'programme' invoke into your minds the thought of socialism. Not being a doctrinaire socialist or a fanatical believer in a proletarian state I may be pardoned if I hold that socialism is, by no means, an inseparable feature of economic planning. Socialism and planning have been keeping company for some time; but the association can be broken if it is certain that the available economic resources can be used to the maximum advantage of the greatest number without the aid of such questionable companionship. Ideas of an economic programme are also opposed on other grounds: viz. that political and economic conditions are continuously changing and that therefore no plan is of any avail. Is

the captain, setting out on a distant voyage, deterred from laying down a course by the fear of wind and weather which might drive him astray ? During the course of his long voyage he may be time and again beaten off his course ; but always he keeps his objective clear and reaches port later if not sooner. Having fixed a period for his labours, the captain concentrates his efforts on his task and his infectious enthusiasm spreads to the crew and even to the passengers ; so much so, the ship reaches port even before the scheduled hour. Therefore in all programmes for development the time-limit is of incalculable psychological value ; it gives tone and point to the activities of the people.

Granting the value and importance of a programme for South Indian agriculture we have to consider what the aim should be of such a programme. Economic self-sufficiency may or may not be a desirable goal for all India; but there can be no question that, that cannot be the goal of agricultural production in South India. The aim of such a programme for our presidency should be the fullest possible utilisation of the natural resources of the country so as to secure efficient and economic production; the elimination of delay and wastage in distribution ; the ensuring for the agriculturist and the producer as large a margin as is consistent with the interest of the consumer; and, more than all, the securing for the large mass of the people as high a standard of living as possible. Besides, we should aim at improving and extending the land under cultivation, at enhancing the variety and the value of the crops produced, at introducing a better live-stock and at strengthening the ryot by the greater spread of education and by the organisation of credit.

These are the general lines of development. But when we think of the peasant and the cultivation of land we seem to hear a cry—ever growing louder and stronger from many parts of the country side—against the heavy burden of land revenue. A demand for reduction of land revenue has been made in this as in several other provinces and the new ministries in various places have put in the front of their programme a reduction in land revenue. Few will question the necessity for reduction which has been long overdue. There have even been suggestions for abandoning resettlement operations since every resettlement in practice has meant an increase in the tax-burden. On the other hand there is grave risk to-day of haphazard schemes of reduction being indulged in, mostly due to election exigencies. A stable system of administration cannot afford to deny itself the advantage of an elastic source of revenue like land, but while preserving this advantage our land revenue system must be revised and remodelled and brought into line with modern concepts of taxation. This is a problem of incalculable importance that is confronting us to-day and it is necessary to solve it in a scientific way. An extensive survey of

agricultural holdings with a view to standardizing the levy of tax on land at a level which will make agriculture a paying concern is an imperative necessity. Side by side with the reduction in land revenue, alternative sources of revenue have also to be tapped viz. agricultural incomes above a certain minimum level. The communique of the Madras Interim Ministry refers to the appointment of a committee to consider the question of land revenue reduction. They expect this committee to finish its labours in a month. It would be well if their labours are extended and if they are enabled by the Interim Ministry or its successor to produce a report after greater deliberation more calculated to further the permanent interests of the people. Curiously enough it has now become necessary to urge caution. There is little danger of ministers forgetting this question since they will be judged later by the measure of relief they give to the large majority of the electorate.

A cry equally insistent is that against the grave burden of rural debt. The agricultural debt in this presidency is about Rs. 240 crores and if equilibrium is to be restored to our economic life, if initiative, enterprise and vigour should return to our agriculture the millstone of debt, that hangs round the neck of the peasant must, be removed. The fixing of the maximum rate of interest and the penalising of higher rates and the scaling down of debts, not by a comprehensive executive fiat but by a careful enquiry into individual cases may appear drastic, but they are by no means desperate remedies. The granting of loans to ryots under the Agricultural Loans Act has worked well in the past and the scheme may be given a wider trial in the future. Next comes debt conciliation which will also be of great benefit to the peasantry. The problem of rural debt can best be faced by co-ordination and pooling of all the sources of rural credit, the professional and non-professional money-lenders, the co-operative institutions and the Joint Stock banks. Cheap long term credit must be secured by establishing a net work of Land Mortgage banks in important centres throughout the country. No scheme for agricultural development can fail to recognise the importance of the co-operative movement. Though Madras comes third in India in the matter of co-operation much yet remains to be done. It cannot be said that the advent of this movement has arrested—let alone diminished—the spread of indebtedness of the agriculturists in this province. So an important item in the economic programme for rural development is the strengthening of the co-operative movement.

However, no programme for agricultural improvement in South India can stop with the reduction of taxes and the lightening of debts. It must include well-thought-out steps to make agriculture a paying industry by changing it from a primitive rule-of-thumb process into a scientifically organised up-to-date industry. Efforts should be made

to improve the productivity of the land by better seeds, by better implements, by a more stable water supply and by the scientific use of suitable manures. Research in plant rearing and plant diseases, study of organic manures and actual demonstration in various ways in the country side must become a very important item in agricultural organisation. Both in extensive and in intensive cultivation the problem of water-supply is of the utmost importance. Comprehensive schemes of irrigation like the Mettur project are not the only remedies for increasing the area under irrigation. Minor irrigation schemes throughout the presidency must be carefully investigated and efforts made to conserve rain water by adding to the tanks and bunds in existence and by improving and repairing them. The importance of adding to the number of irrigation wells can be easily realised from the fact that 14·7% of the cultivated land in the Presidency is irrigated by wells. Another means of improving the lot of the cultivator is by eliminating the fragmentation and sub-division of holdings. Sub-division is the distribution of the land among a number of holders due to inheritance, gift or sale, while fragmentation refers to the manner in which the lands are held. If a man's holdings lie apart from one another so that he has to pass through other men's holdings to go from one to another, then his holdings are said to be fragmented. Sub-division and fragmentation often lead to uneconomic holdings, i. e. holdings which do not leave the ryot and his family for supporting himself and his family after his expenses are met. This evil can be successfully tackled through the co-operative movement as in the Punjab.

Another line of reform is the improvement of agricultural marketing. At present the ryot has often to sell his produce at a time of low prices in order to pay the land tax or to pay the money lender. The absence of standardised weights and measures and grading of produce and the prevalence of adulteration together with the ignorance of the seller and the secret settlement of prices prevent the peasant from realising the just prices for his goods. Recent investigations of the Government of India Marketing Officer into the marketing of wheat has revealed the extent of these evils; these can be remedied by bringing into being co-operative sellers' organisations, by putting down adulteration with a stern hand and by insisting always on standardised weights and measures. Government or co-operative organisations can help much by providing a net work of licensed warehouses where goods can be stored, the vouchers for which can be given the validity of negotiable instruments. Financing companies for the marketing of goods can also be attempted. A step in this direction has been taken at Chidambaram where a Paddy Sales and Loans Society has been working for some time.

Provision of subsidiary occupations for the Indian cultivator is yet another means of improving his economic position. The handloom

industry in India has yet a future and it will, without doubt, help to provide the cultivator and his family with spare time occupation. In a country which is predominantly rural and agricultural, it is only the development of cottage industries that will restore prosperity, with the minimum of friction and dislocation in the social and economic structure of the land. A supply of cheap power will undoubtedly stimulate scattered industries. Apart from this, basket-making, cattle-rearing and dairying must also be encouraged. The importance of improving dairying in our presidency can be gauged by the fact that India consumes every year (according to reliable authority) 540 crores worth of dairy products and that the consumption *per capita* can easily be doubled. Fruit gardening and vegetable growing also seem to have a greater future before them.

A unified economic programme for the rural development of this Presidency must involve a permanent unified direction and planning. This can best be secured only by a permanent Central economic council representing expert opinion. Schemes for development must be considered and recommended by them in the first instance. Then they must be considered by the executive Government and placed before the legislatures for sanction and approval. In the interests of sound progress there should be District Economic Councils working along lines set down by the Central Council. We have both these in our presidency; but their positions should be strengthened and there should be greater recognition of their importance. It is a useful common platform for officials and non-officials to work together in constructive schemes for the amelioration of the conditions of the toiling millions. Another method of taking knowledge and progress to the doors of the peasant is the appointment of Rural Guides who will be the guide, philosopher and friend of the villagers in economic matters. The present Viceroy has rightly laid stress on the necessity for greater and closer contact between the people and the officials of Government. The most effective way of helping the peasants can be devised only by studying them and their leaders at close quarters without fighting shy of co-operating with those with whom they are not always in agreement.

When these comprehensive suggestions are placed before the hard-backed practical man very often he says. "Well and good. Your scheme is good indeed; but where is the money to come from?". It is true that the path of reform is strewn with the bones of forgotten schemes and many a goodly proposal which started with the fair wind of enthusiasm has split on the rock of finance. But the practical administrator, the experts and the officers in charge of various departments must bear in mind the old adage that you cannot measure cloth without a yard stick. Whenever new proposals are made the temptation is to turn them down for want of funds. But many a scheme

which is derided and pooh-poohed at first, turns out in the long run to be filled with undreamt-of benefits. Wind and weather seem to be favourable now for embarking on works of development. There is a glut of cheap money in the market. The proposal, therefore, for a loan of one crore of rupees by the Government is to be welcomed. It must however be utilised on schemes permanently beneficial to the agriculturists in the presidency.

Even if only some part of these suggestions becomes accomplished, the peasant will be freed from the spell of starvation and ignorance and villages instead of stagnating and decaying will hum once again with activity. This programme will include definite provision of good roads, water supply and hospitals for men and beasts. Villages will be provided with the amenities of civilised life, with the cinema and the radio, and the village will have all the advantages of the town with none of its disadvantages. Such changes in the face of the country, a new order which makes this possible, is called for both by sound commonsense and by the compelling call of common humanity. How can one look unmoved at starvation in the midst of luxury, at naked poverty by the side of princely extravagance, at the peasant's one-roomed hut by the side of palatial mansions? The heart-rending conditions that prevail in rural India can be effaced if only legislators and ministers seriously and sincerely give their minds to the great work that awaits them and extend willing hands to feed the hungry and relieve the poor and the suffering.

THE ORGANIZATION OF RURAL RECONSTRUCTION WORK

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The ultimate aim of Rural Reconstruction work is to enhance the happiness of the masses and the chief factors which make up happiness may be said to be health, wealth, and culture, provided they are made right use of. To promote these, efforts have to be made in two directions. One is to educate the masses and develop in them a wider, freer and more intelligent out-look and create a genuine desire and effort for their own improvement. The other is to see that their efforts in various directions are encouraged and helped with advice, guidance and resources by various departments of the State, and other organizations.

Though the various departments of the State, the District Boards, Dt. Economic Councils and other quasi-official bodies have each been and can do much to help the masses to uplift themselves, yet, an independent non-official organization which commands the confidence of the people, appears essential to act as a laison between them and

these official or quasi-official bodies. " That the scheme of rural development cannot make any headway unless (a) it is pursued through an agency as far as possible non-official and (b) it is guided by bodies able to control and co-ordinate activities of the constructive departments of Government" is the opinion of the Nizam's Govt. published in a recent note. I shall now try to develop a clearer picture of the organization and lines of work I have in view.

The village is naturally the primary unit for any attempt at rural reconstruction, and it would be ideal to have one whole-time worker in each village. But this may not be practicable under the present conditions. If tangible results are to be achieved we must have at least one whole-time worker for a group of villages within an area of about six miles square from the centre of which he may be able to visit all the villages of the group on foot or on a bicycle without fatigue, and this is, I believe, what we may hope for at present. In the Vizagapatam district for example, each such unit area will on an average have 23 villages with a population of 20 thousands, and an average taluq will have eight or nine such units. In the East Godavary (plains) which is an example of a deltaic area, each unit, six miles square, will have only 12 villages but with a population slightly higher, about 24 thousands, each taluq again having the same number of units.

The rural worker, should be a real friend and guide of the villager. To begin with, he should approach some intelligent men in the villages and after explaining his aims to them enlist their sympathy. He may also select one or more part-time workers in each village to help him in his task. With their help he should first study the local conditions and make as detailed an economic survey as possible. With the help of these and others whose sympathy he had so far enlisted he should start propaganda amongst the masses to make them understand his aims. While educating them in the general sense of the term and making them realise the present defects in their social and economic life and the effects of these on their health, wealth and happiness in general, he should create a desire and effort for improvement. At first each individual may be taught to improve himself and his family but in course of time, he should be made to extend his effort to the improvement also of the village in general, creating a feeling of 'each for all and all for each.'

To revive and foster a corporate spirit in the villagers, some kind of organization such as a simple village improvement association may be formed in each village and later developed into a co-operative society or statutory Panchayat Board. Special Associations or guilds for promoting particular industries may also be organised in course of time.

Side by side with the education of the villagers and their organization into a corporate body and training them to uplift themselves,

as far as it lies in their capacity, the worker has to see that the different departments of the State render their services to the villagers in the proper manner and to an adequate extent. State departments are of two classes; (1) *constructive* e.g. as the Health, Education, Agricultural, Veterinary, Industries and Co-operative departments which are solely intended for the benefit of the people, and (2) *governing* such as Revenue, Police, Judicial and other Departments mainly administrative in their character. Without an adequate and properly trained staff in the lower ranks to render actual service to the masses in all parts of the rural areas, the departments of the former class cannot make their services felt or appreciated by the masses. Each Department should have a representative in every unit of six mile square referred to above. It should be possible that a single man may be entrusted with certain items of work of more than one of the allied departments such as Health, Veterinary or Agricultural, in the same centre. Mention may be made here of the experiment now being done by the Agricultural department in nine taluqs of the Vizagapatam district by providing each demonstrator with eight demonstration maistries, at about one for every 15 to 25 villages.

Though the administrative departments are not expected to do much of direct service to the masses they can yet do much to enhance their happiness by showing genuine sympathy in their administration. It is also the duty of the rural worker to evoke this in the officers of the different departments and to see that the masses do not suffer from their apathy or indifference. The villagers have also to be taught to appreciate the services of the various departments trying to ameliorate their condition, and utilize the same readily and to their best advantage. In fact, they must be taught to demand the services of the departments whenever in need, and see that there is a prompt compliance.

By the adoption of simple improvements in Agriculture or other industries now being followed by the villagers, their present income may slightly be increased so that they may in course of time adopt other improvements which may require a small capital. Loans may also be obtained from the Government or through co-operative organizations for undertaking agricultural or other improvements or to redeem debts. For minor and recurring items of expenditure concerning the village as a whole, a common good fund may be organised from the communal resources, but there may be some others which require financing from outside. The Government or the District Board has to be approached in such cases for grants. The worker has to help the villagers in obtaining these loans or grants in time and see that they are properly utilized. Besides thus helping the villagers to improve their material condition the rural worker has also to attend to their moral, social and cultural improvement also.

These, in brief, are the chief functions of the rural worker. To take up these arduous duties an intelligent man with sufficient education, experience in life and a spirit of service to the country is required. One who has deliberately chosen service of this nature depending upon his own resources or on a moderate honorarium for his maintenance, should be selected and trained in a suitable training institute for about an year or two. He may then be made to work in a rural reconstruction centre already in a proper running order for about one or two years before he is put in independent charge of a new centre. By this time he should be about 25 years old.

The agency which guides, controls and pays such rural workers should preferably be non-official. A committee of active rural reconstruction workers and others who are prepared to devote their time, money or property to this cause may be organised in each district with a sub Committee for each centre for direct control. A central provincial organisation may be necessary to co-ordinate work in the districts. No member of any of these bodies should have any political activities. A register of all such workers in each district who are willing to devote their energies, monies or property to this cause and sign a pledge not to participate in politics for a definite period, say five years, may be maintained and the provincial, district and local committees formed from among those on the list.

A rural reconstruction worker, may, if he has no independent means of subsistence, be paid an honorarium of Rs. 15—25 per mensem during the period of training—Rs. 15 if he is a bachelor and Rs. 5 for every addition to his family. The initial amount after his being put in independent charge of a centre may be Rs. 25, an increment of Rs. 5 being granted at intervals of not less than three years subject to a maximum of Rs. 50.

Whenever a new centre is opened the wages of the worker for at least five years should be assured. It would be preferable to be assured of funds for ten years, by which time the local committee should be made to make its own arrangements for paying its worker. The amount required for a ten year period will be about ten to twelve thousand rupees. But if an amount of Rs. 20,000 could be invested, at the start, in some safe securities fetching, say, an interest of 3 per cent, this interest will be sufficient to pay a worker and contingencies for all time, his services being utilised to start a new centre once in 5 to 10 years as soon as the old centre is able to manage its own affairs. The rural worker is the greatest necessity in the reconstruction of village life and if one is provided for every group of villages within a reasonable distance of his residence, he should be able to find the material and money required for the improvement of each village from sources within or without.

All efforts should therefore be concentrated on the finding of the necessary funds for the payment of these workers and for the institutions needed to give them the necessary preliminary training. About a crore of rupees will be required annually for the 14 or 15 thousand workers required to cover the whole of India including Native States. An investment of 30 crores will yield this amount of interest. The sooner this is provided the better, but it does not matter if workers are not provided for the whole area at once, provided a definite policy is laid out and adopted.

STUDIES ON *ELASMUS ZEHNTNERI*, FERR., A PARASITE OF THE SUGARCANE WHITE MOTH BORER (*SCIRPOPHAGA*)

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Introduction. The paper deals with the life history, habits and other interesting features of *Elasmus zehntneri*, Ferr., a chalcid parasite of the sugarcane white moth borer (*Scirpophaga*). As far as the authors are aware this wasp has not been mentioned in any of the many publications on South Indian parasites ; hence the detailed studies on this wasp.

History of the Parasite. The parasite was first collected from West Java on the sugarcane borer—*Scirpophaga intacta*—and described as *Elasmus* sp., by Zehntner (*Meded v. h. Proefstation v. Suikerriet West Java*, No. 46, 1900, p. 1.). It was named *Elasmus zehntneri* by Ch. Ferriere in his paper on "The Asiatic and African species of the genus Elasmus, Westw, in *Bull. Ent. Res.* Vol. XX. Part IV (1929), pp. 411-423. Besides Java, the parasite has been noted from the Philippine Islands and Formosa. In N. India it was first noted in the Punjab as will be seen from the "Summary of the more important results arrived at or indicated by the Agricultural stations and Research Officers in the Punjab during the years 1930-31—34-35" published in 1936. The parasite has been observed by the authors for the first time in S. India in November 1935 in Scirpophaga attacked stems collected from Coimbatore.

Life History of the Moth Borer. A brief account of the nature of damage caused by the moth borer along with its life history and habits is given here so as to indicate clearly the relationship between the host and its parasite. Out of the characteristic buff coloured egg mass which is generally laid on the under-surface of the leaf of sugarcane plants, tiny caterpillars hatch out and bore into the shoots and destroy the growing point. The caterpillar is often very destructive

to young canes. When the larva is full grown it constructs a short tunnel at right angles to the original tunnel and closes in with a lid constructed from the outermost leaf sheath. It then retreats constructing a number of silken partitions and pupates, and in due course the moth emerges. The total life cycle of the borer is 2 to 2½ months.

Description of the Parasite by Ferriere is given below:—

Female. Head and thorax black with greenish shine; abdomen orange, the two last segments, lines on the sides of the 2nd and 3rd segments, and triangular spots on the sides of the 4th and 5th segments, black. Antennae yellow, the 2nd joint black above. Legs pale yellow, almost white, coxae and femora of the middle and hind legs black on upper margin, the tarsi somewhat brown. Wings hyaline, with yellow nerves.

Female. *Head* short, narrower than *thorax*. *Thorax* long and narrow, flattened above. Mesonotum covered with fine ciliae. Scutellum almost quadrate, longer than broad. Propodeon broad at the basis, concave behind, smooth and shining. *Abdomen* elongated with the form of a triangular pyramid. The ovipositor projects very little beyond tip of the abdomen. Antennae with ten joints; the 1st (scapus) flattened and enlarged below; the 3rd (anellus) very short, oblique; the 4th (2nd anellus) also very short, but longer than the 3rd; the 5th (1st funicle) three times as long as broad; the two following gradually shorter and broader, the three last forming a club. *Legs* with the coxae broadened very much; femara less broadened, tibiae short, and tarsus very long in the hind legs. Hind tibiae with lozenge-shaped lines covered with short rigid hairs. *Wings* with marginal nerve longer than sub marginal, stigmal nerve very short; at basis of wing two narrow hairless parts.

Male. Smaller than female; abdomen paler yellow and the triangular black spots on the sides of the 2nd—5th segments broader; on 5th segment the spots join above so that only the hind border remains yellow. Antennae with long ramelli on 4th, 5th and 6th joints; 7th joint long, as long as two-thirds-of 3rd ramellus; club narrow.

Length, Female 2·8—3 mm., *Male* 2—2·25 mm.

Type locality: West Java.

Host: *Scirpophaga intacta*, Sn., a sugar-cane borer.

Emergence and Behaviour of the Parasite. The adult parasites emerge by cutting small holes through the lid constructed by the host larva before its pupation. Generally the adults are active immediately

after emergence and mating takes place on the same or on the subsequent days. Eggs are laid even as early as two to four days after emergence. The female lays eggs only on such of the caterpillars which construct the outer lid of emergence and in this respect the wasp resembles *Stenobracon nicevillei*, Bingh., and *Rhaconotus scirpophagae*, Wlk., two other parasites of the same host. The parasite, after locating a larva inside the stem, waits till it begins to construct the lid. It then thrusts its ovipositor through the lid, stings the caterpillar and lays eggs in clusters either on the host or attached to the inner circumference of the tunnel. **Table I** gives the egglaying records of ten mated females. The maximum number of eggs in one cluster laid on a host on the first day was 55, the average for ten such clusters being 36. The maximum number of eggs laid by a female was 97 (laid on four hosts, on four different days) and the minimum 30. It is also seen from the table that the average is 53 and that all the eggs are not laid on a single day. **Table II** records the number of adults emerged from parasitised hosts brought from the field. One such larva gave rise to 170 adults, the lowest number was 30 and the average 75. It is seen from the table that there were more females than males, the proportion being 2 to 1. Our studies on the wasp have indicated the occurrence of super-parasitism in this species. Super parasitism, however, does not occur commonly and may take place only when there is scarcity of hosts. It was found that when a parasite was supplied with two host larvae, one a parasitised and the other a healthy caterpillar, it preferred the latter to lay its eggs.

Table I.

Records of oviposition of Ten mated Females of

'Elasmus zehntneri' Ferr.

Female No.	Emerged on	1st batch		2nd batch		3rd batch		4th batch		Died on	Total No. of eggs.	Average.
		No. of eggs laid	Laid on	No. of eggs laid	Laid on	No. of eggs laid	Laid on	No. of eggs laid	Laid on			
1	27 3 36	30	2 4 36	23	3 4 36	27	4 4 36	17	6 4 36	10 4 36	97	
2	27 3 36	38	19 4 36	27	22 4 36					23 4 36	65	
3	27 3 36	55	21 4 36	15	22 4 36					23 4 36	70	
4	9 4 36	39	17 4 36							20 4 36	39	
5	20 4 36	32	23 4 36	20	24 4 36					28 4 36	52	
6	20 4 36	30	23 4 36							30 4 36	30	
7	6 5 36	34	8 5 36							12 5 36	34	
8	20 5 36	30	30 5 36	18	31 5 36					2 6 36	48	
9	21 6 37	34	3 7 37	25	5 7 37					11 7 37	59	
10	22 6 37	37	3 7 37							4 7 37	37	
												53

Table II.

Statement showing the number of Parasites emerged from each host larva collected from the field.

	Ser. No.	Month in which adults emerged.	Total No. of adults.	Females	Males.
		1936			
	1	March	55	45	10
	2	April	68	52	16
	3	August	170	98	72
	4	,,	103	56	47
	5	,,	125	66	59
	6	,,	56	50	6
	7	,,	89	55	34
	8	,,	78	39	39
	9	,,	109	65	44
	10	October	42	22	20
	11	,,	30	25	5
	12	November	53	32	21
	13	,,	88	60	28
	14	,,	30	26	4
	15	December	35	25	10
	16	,,	40	28	12
	17	,,	50	35	15
		1937			
	18	January	79	49	30
	19	April	48	35	13
	20	,,	72	56	16
	21	June	162	98	64
	22	July	85	59	26
	23	August	34	27	7
	24	,,	63	54	9
Average number of adults emerged from each host larva.			75	50	24

Life History. *Egg*: The eggs (fig. 3) are generally transluscent, about ½ mm. long, elongate, cylindrical, curved at the centre with one end more pointed than the other. They are laid attached to the inner circumference of the tunnel or in some cases on the head of the host caterpillar, in the form of a bunch of grapes (fig. 2). Just before hatching, the grub is clearly seen through the transparent egg shell. The egg period ranges from 19 to 21 hours.

Grub: The newly hatched grubs measure ½ mm. If the eggs are laid, away from the host, the grubs when hatched out, glide on the smooth silken lining of the tunnel until they reach the host. They crawl over the host and puncture its skin at some tender part of the cuticle and suck the juice from the host's body. When newly hatched, they are cylindrical, white and transparent and as they ingest food from the host they become opaque by attaining the color of the host. The grubs reach their maximum size of 3½ mm. × 1 mm. in two or four days (fig. 4) by which time the host larva is completely eviscerated after which they cast their larval skin and turn into naked pupae. The larval period is 2—4 days.

Pupa: The pupa measures $3\frac{1}{2}-4$ mm. × 1 mm. in the case of females and $2\frac{1}{2}$ mm. × 1 mm. in males. It is conical with the broadest width at the thoracic region tapering gradually to a point posteriorly (fiig. 5-a). The rudiments of legs and antennae on the ventral side and of the wings on the dorsal side (fig. 5-b) are clearly visible. The freshly formed pupa is uniformly white and 2 days later the eyes assume the reddish brown color and a day later they turn black. The whole pupa turns brownish on the 4th day and three days later it is completely black. It is easy to separate the sexes as the males measure distinctly less than the females. The adults emerge after 7—10 days.

Total Life Cycle. The parasite has the advantage of completing its life cycle in 10—13 days while the host takes four times as much to produce one generation. **Table III** gives the life-history records of 30 parasites.

Table III.

Detailed Life-history Records of 'Elasmus zehntneri', Ferr.

Serial No.	Eggs laid on.	Larva hatched on.	Duration of egg period in days.	Pupated on.	Duration of larval period in days.	Adults emerged on	Duration of pupal period in days.	Total life cycle.
1	28 3 36	29 3 36	1	31 3 36	2	9 4 36	9	12
2	28 3 36	29 3 36	1	31 3 36	2	8 4 36	8	11
3	2 4 36	3 4 36	1	6 4 36	3	15 4 36	9	13
4	3 4 36	4 4 36	1	6 4 36	2	15 4 36	9	12
5	3 4 36	4 4 36	1	6 4 36	2	13 4 36	7	10
6	4 4 36	5 4 36	1	7 4 36	2	15 4 36	8	11
7	4 4 36	5 4 36	1	7 4 36	2	15 4 36	8	11
8	6 4 36	7 4 36	1	10 4 36	3	19 4 36	9	13
9	17 4 36	18 4 36	1	20 4 36	2	28 4 36	8	11
10	17 4 36	18 4 36	1	20 4 36	2	28 4 36	8	11
11	19 4 36	20 4 36	1	22 4 36	2	30 4 36	8	11
12	21 4 36	22 4 36	1	24 4 36	2	2 5 36	8	11
13	22 4 36	23 4 36	1	25 4 36	2	3 5 36	8	11
14	23 4 36	24 4 36	1	26 4 36	2	4 5 36	8	11
15	23 4 36	24 4 36	1	26 4 36	2	4 5 36	8	11
16	24 4 36	25 4 36	1	27 4 36	2	6 5 36	9	12
17	25 4 36	26 4 36	1	28 4 36	2	6 5 36	8	11
18	8 5 36	9 5 36	1	11 5 36	2	19 5 36	8	11
19	14 5 36	15 5 36	1	17 5 36	2	26 5 36	9	12
20	31 5 36	1 6 36	1	3 6 36	2	11 6 36	8	11
21	5 6 36	6 6 36	1	8 6 36	2	18 6 36	10	13
22	30 6 36	1 7 36	1	2 7 36	2	9 7 36	7	10
23	6 10 36	7 10 36	1	10 10 36	3	19 10 36	9	13
24	7 10 36	8 10 36	1	11 10 36	3	20 10 36	9	13
25	7 10 36	8 10 36	1	11 10 36	3	20 10 36	9	13
26	8 10 36	9 10 36	1	12 10 36	3	21 10 36	9	13
27	9 10 36	10 10 36	1	13 10 36	3	22 10 36	9	13
28	13 11 36	14 11 36	1	17 11 36	3	26 11 36	9	13
29	14 11 36	15 11 36	1	18 11 36	3	27 11 36	9	13
30	3 7 37	4 7 37	1	8 7 37	4	16 7 37	8	13

Longevity of Adults. It is seen that the parasites feed freely on honey solution under the laboratory conditions. **Table IV** records the longevity of 24 parasites from which it is clear that the maximum length of a female was 26 days while that of a male was 7 days. Without food both males and females did not live for more than three days.

Table IV.

Length of Life of 'Elasmus zehntneri', Ferr.

	With food					Without food				
	Ser. No.	Emerged on.	Died on.	Sex of the adult.	No of days lived.	Ser. No.	Emerged on.	Died on.	Sex of the adult.	No. of days lived.
	1	11 4 36	2 5 36	F	21	1	4 10 36	7 10 36	M	3
	2	11 4 36	2 5 36	F	21	2	4 10 36	7 10 36	M	3
	3	4 10 36	11 10 36	M	7	3	4 10 36	7 10 36	M	3
	4	4 10 36	11 10 36	M	7	4	4 10 36	7 10 36	F	3
	5	4 10 36	11 10 36	M	7	5	4 10 36	8 10 36	F	4
	6	4 10 36	13 10 36	F	9	6	4 10 36	8 10 36	F	4
	7	4 10 36	13 10 36	F	9	7	11 4 37	13 4 37	F	2
	8	4 10 36	30 10 36	F	26	8	11 4 37	13 4 37	F	2
	9	4 10 36	12 10 36	F	8	9	11 4 37	13 4 37	F	2
	10	4 10 36	12 10 36	F	8					
	11	4 10 36	9 10 36	M	5					
	12	4 10 36	11 10 36	M	7					
	13	4 10 36	8 10 36	M	4					
	14	4 10 36	11 10 36	M	7					
	15	4 10 36	9 10 36	M	5					
	16	6 11 36	17 11 36	F	11					
	17	12 4 37	18 4 37	F	6					
	18	26 4 37	10 5 37	F	14					
	19	26 4 37	30 4 37	M	14					
	20	26 4 37	4 5 37	F	9					
	21	26 4 37	14 5 37	F	19					
	22	28 6 37	4 7 37	F	6					
	23	28 6 37	11 7 37	F	13					
	24	28 6 37	22 7 37	F	24					
Average longevity for males					6					3
Average longevity for females					14					3

Seasonal and Regional Prevalence. Field observations on the incidence of parasites under Coimbatore conditions show that although the wasps are present throughout the year they are found in large numbers only from August to January.

The parasites have been noted from the following places in the Madras Presidency :—Bobbili, Vizagapatam, Godaveri, Chittoor, Tanjore and Coimbatore districts.

Efficacy of the Parasite. It will be seen from the above mentioned habits of the parasite that it has certain drawbacks as well as advantages. Though it is a larval parasite it does not attack caterpillars of different stages but attacks only those very near pupation. Again the female parasite has only a few victims as the eggs are laid in clusters. Against these two disadvantages the following advantages may be mentioned: (1) The parasite has only a short life cycle when compared with that of the pest which takes 2—2½ months to complete one life cycle. Given favourable conditions there are four generations of the parasite for every one of the host. (2) No hyper-parasites have

been noted on the parasite to reduce its efficacy. (3) The parasite has not been noted till now on any other host and hence it is specific in action. (4) The egglaying capacity of the female is also fairly high the maximum and the average being 97 and 55 eggs respectively. (5) The rearing of parasites under laboratory conditions is not difficult as stems with larvae having plugs were readily accepted by the parasite.

From these observations it will be clearly seen that *Elasmus zehntneri*, Ferr., is a fairly efficient parasite of the sugarcane stem borer.

Acknowledgments. The authors take this opportunity of thanking Mr. A. B. Gahan for having kindly identified the specimens.

Research Notes.

I

Mite pests of Citrus.

Insects affecting citrus are many of which the fruit sucking moths, the citrus butterfly, the leaf miner etc., are the most troublesome. Besides insects there are mites (Acarina) which occasionally do some damage. One of these—*Tetranychus*—(*Schizotetranychus*) *hindustanicus*, Hirst. sucks the leafsap with the result that discoloured patches are produced on the leaves. The adult mites which are greenish yellow in colour are found also on Persian neem, margosa and 'curry leaf' plant.

There is yet another mite—an Eriophyid—which attacks citrus fruits. It has been noted for the first time in South India from Penagulur (Cuddappa district) and Poonapalle (Chittoor district). Studies on the mite have shown that as a result of the attack of the pest a rust-like discolouration is produced on the surface of the fruit which appears to be due to the mites feeding on the epidermal cells causing the surface of the fruit to harden. It has however to be stated in this connection that the attacked fruits do not show any difference in taste from the un-attacked ones, but according to the owners of gardens the damage to fruits reduces their value. Detailed studies regarding the pest and its control are in progress.

M. C. Cherian,
Govt. Entomologist.

II

A Banana from Hawaii.

Of the 5 varieties of Bananas received from Honolulu, Hawaii, *Palua* proved to be *Kaio*. This *Kaio* variety has the look of *Nendran* from the beginning of its growth but on flowering it proved different in that it had neither the persistent bract nor the persistent neutral flowers. It has the ordinary naked axis bearing male flowers. The unripe fruits are excellent, even better than *Nendran* for making fritters (crisps). It is also excellent for other vegetable preparations. The colour of the flesh is the same as that of *Nendran*. The fruit on ripening is found to have the same taste and flavour of *Nendran*. The flesh of the ripe fruit is soft and has sub-acid taste. The ripe fruit does not keep well. The ripe fruit is therefore inferior to that of *Nendran*. This variety has to be tried in the West Coast to see whether the sub-acid taste might undergo any change A bunch produced at the Banana Experimental Area, Coimbatore, had 9 hands, 91 fingers and weighed 35½ lbs. The shape of the fruit is very peculiar in having no apex at all. Hence the local name *Motta Nendran* is suggested for this variety.

K. Cherian Jacob,
Assistant in Botany.

EXTRACTS

Jam Making. Always choose good fruit in making jam. Over-ripe fruit seldom produces good jam. When leaving fruit to stand over-night sprinkle with sugar. Use an enamel or earthenware vessel ; aluminium and fruit acids affect one another. Do not overcrowd the preserving pan, allow plenty of room in the pan for the jam to boil and rise, if necessary.

When sugar is added, it should be quite dissolved before the jam boils. The longer the jam is boiled the better it will keep. When cooking jam with little or no water added, stir often and thoroughly from the bottom of the pan to ensure it not sticking. Jam generally should be boiled fast to keep a good colour. No definite time. Fruit and rate of boiling vary in each case. It is a matter of choice whether the bottles done are sealed whilst hot or cold. When covered with paraffin wax they are better done when the jam is cold otherwise the wax will not adhere to the sides of the bottles, which is necessary to make them air-tight. There are inexpensive cellophane and gummed covers on the market to day, which make the sealing of jam an airy cupboard, but it should be cool, dry and dark.

Recipes. Fig jam.—To every 1 lb. of figs allow 1 cup water and 1 lb. sugar. Boil water and sugar first ; as soon as sugar is melted put peeled figs in and boil together until thick. Add few almonds and ginger to taste.

Banana and pear jam.—12 bananas, 4 lbs. juicy pears, juice of 4 lemons, 6 lbs. sugar. Put 21 lbs. sugar in preserving pan squeeze over the lemon juice and allow it to dissolve. Peel, core, and cut up the rest of sugar and the bananas cut up small, stir until it boils, simmer five minutes. Skim and boil fast for an hour or until it jellies

Grape jam.—4 lbs. grapes, 3 lbs. sugar ; wash grapes and strip from stalks, place in pan and crush slightly. Bring slowly to the boil. Boil fruit half an hour, add sugar, and stir until dissolved. Boil fast until jam sets. Seeds can be removed as they float to the top. (*Journal of the Dept. of Agri. S. Australia*—May 1937.)

Pruning the Tea Plant. J. R. Tubbs (*J. Pom. and Hort. Sci.*, 14 (4), 317; 1937) has estimated that the young shoots of the tea plant (*Camellia Thea*) of which the majority of leaves are normally harvested almost as fast as they grow, have produced at the time of harvesting only half the amount of carbohydrate used up in their development. The consequent continued depletion of the reserves of the bush frequently causes die-back of branches, followed by fungal attack and the death of the whole bush. An investigation on plantations at 200 ft., 1,500 ft. and 4,600 ft. above sea level showed that die-back was more common at the lower elevations, and smaller amounts of reserve carbohydrate were found in the roots. Several methods of pruning were tried, and it was found that by allowing a number of branches to retain their foliage, a method designated "lung pruning", the drain on carbohydrate was checked and the incidence of die-back reduced. (*Nature* May 22, 1937).

Deterioration of paper. Technical Bulletin No. 541, November 1936, of the United States Department of Agriculture, Washington, D. C., deals with the "Deterioration of Book and Record Papers" and is written by T. O. Jarrell, J. M. Hawkins and F. P. Veitch. It appears to be the general opinion of librarians that much of the paper of books and records on their shelves, especially that made since about 1860, is not sufficiently durable. This conclusion applies especially in the case of books and papers subject to frequent handling. Thirty-eight samples of paper taken from old books, magazines and court records, ranging in age from 19 to 169 years, were examined. The results seem to indicate

that paper actually absorbs from the air harmful quantities of acidic sulphur compounds with which the air is generally polluted. The absorption is greater in the portions of the leaves more fully exposed to the atmosphere, and this is one reason why the leaves of old books become more brittle near the outside edges. Seven samples of commercial bond and ledger papers, made in 1914 and 1915, were tested after storing under normal conditions for eighteen years. They were examined after five years and again after eighteen years storage. After eighteen years, the folding endurance of these papers had decreased 23--93 per cent. and the bursting strength 0--18 per cent. In general, papers with the higher acidity, as indicated by the pH of their water extract, suffered the greatest deterioration. The results are indicative that a water extract with a pH of less than 5 is a major factor in the deterioration of even the best classes of paper. (*Nature*, May 22, 1937.)

ABSTRACTS

Zinc as a nutrient for Plants. Chandler, W. H. *Bot. Gazette*, 98 (1937), 625—646. There is strong evidence that zinc is an essential element for fungi and for higher plants; but, because of the very small amount of zinc required and its widespread presence as impurities, it has required exceptional methods to hold the zinc supply to plants in water cultures low enough to prevent moderate growth. Earlier workers were able to cause some improvement by supplying zinc, but some of them considered this response merely a stimulation, because the growth of check plants was approximately normal.

Widespread and serious injury to trees in orchards has been overcome by treating the trees with zinc, through the soil, by driving zinc or galvanized iron into the trunk or branches, and by spraying with zinc compounds on the foliage or on the dormant twigs.

The trees seem to take only about one ounce of zinc a year from an acre of soil, but under some conditions they are not able to obtain enough even for this small requirement. This is not always due to a small total zinc supply in the soil or to a reaction unfavourable to the solution of zinc. The soil flora seems to be involved: some soils in which plants show zinc deficiency will supply enough zinc after they have been sterilized. Theories are suggested to explain these phenomena.

The role of zinc in the plants is not known, but it is rather generally thought to act as a catalytic agent in some essential reaction. (Author's summary).

The age of a Cow and its Effect on Milk. *Queensland Agricultural Journal*—June 1937. How does the age of a cow influence the composition of its milk? This is a question often asked. From the dairyman's point of view the fat is the most important constituent; and much experimental work has been carried out to determine how the fat test varies with the age of the cow. It has been shown that, with advancing years, cows produce milk containing a diminishing percentage of fat. The variation observed is not of any serious consequence, but it is nevertheless noticeable when average figures are taken. A cow of a high testing breed, which shows an average test of 5 per cent. of fat as a young animal, will decline to about 4·5% if she continues to produce to fourteen years of age.

It is sometimes thought that a heifer showing a low test as a two-year-old may improve as she matures. There are no grounds for such a belief, and any farmer building up hopes of this nature is likely to be very disappointed. The richness of milk is a matter of inheritance, and so far as is known nothing can be done to change it in an individual animal.

An interesting feature with this work is that mathematicians have taken an interest in it, and one man has actually worked out a formula for calculating the fat test for any specified age, provided that the average test for the first milking period is known.

The effect of age on the other constituents of milk has also been studied and there is a decrease, with age, in all constituents except albumen, which increases slightly from year to year.

The effect of age on the fat test (richness) of milk should not be confused, with the effect of age on milk production. There is a gradual increase in the quantity of milk produced from year to year until a maximum period is reached after which the production figures show a slow decline. The age of maximum milk production for most breeds has been shown to be eight or nine years,

Chlorosis of Citrus in Puerto Rico. *Phytopathology*, Vol. 27, No. 6. Citrus leaf chloroses due to plant nutrient deficiencies have been reported in almost every region in which citrus plants are grown. Information regarding the causes and distribution of these diseases is in many cases incomplete. This note describes the symptoms and soil relations of a chlorosis causing losses to grapefruit growers in Puerto Rico, and reports the beneficial effects on diseased trees of zinc sulphate, already used elsewhere successfully in the treatment of "mottle-leaf" in citrus. It thus records the occurrence in an additional geographical area of what appears to be a similar deficiency disease.

The symptoms on diseased grapefruit trees in Puerto Rico resemble closely those described for the citrus disease known as "mottle-leaf" in California and "frenching" in Florida. Irregular chlorotic blotches first develop between the larger secondary veins on each side of the leaf midrib, becoming more pronouncedly yellow and increasing in area with increased severity of the disease. In severe cases tissues next to the larger veins and midrib remain green, while the rest of the leaf becomes completely yellow. Trees affected for several seasons frequently produce multiple buds resulting in a bushy growth at the ends of the part or most of the branches. Severely affected trees bear little or no fruit and finally become so weak that they are commercially valueless.

Diseased trees in Puerto Rico have been found on areas of alkaline soil of sedimentary origin, testing pH 8·0 to 8·5 near affected trees, none having yet been found on the acid soils of the island.

In preliminary tests, lots of 5-year old, severely diseased trees were sprayed with water solutions of copper sulphate, iron sulphate, zinc sulphate and manganese sulphate. Three weeks after the sprays were applied trees treated with zinc sulphate began to show signs of response. New healthy appearing leaves were formed, and some of the chlorotic leaves began to recover their green colour. Five weeks and 7 weeks after treatment diseased trees sprayed with zinc sulphate continued to show favourable recovery. Trees treated with copper sulphate shed their leaves. Iron sulphate and manganese sulphate gave no response.

Agricultural Jottings.

(THE DEPARTMENT OF AGRICULTURE, MADRAS)

The Mahali Disease of Arecanuts. *Success of Departmental Propaganda.* It will be recalled that about this time last year the arecanut gardens in several parts of South Kanara district were in the throes of a devastating disease known as *Mahali* or *Koleroga.* To many ryots in South Kanara and South Malabar, arecanut is a money-crop while to a large section of the poorer ryots, it happens to be their sole means of livelihood. The disease is by no means new to the

district. The cause of the disease, the nature of its spread and means of combating it were investigated for over a quarter of a century. The disease is caused by a water-loving fungus (a tiny mould-like organism) which can flourish only during very wet and humid weather. It is for this reason that the fungus is active during heavy monsoon rains on the West Coast and for the same reason some garden owners are lucky to escape its depradations in some years when the monsoon is either weak or intermittent. The Department of Agriculture has realised the danger of ryots gambling with the monsoon and has advocated a pre-monsoon spray to the young arecanut bunches with a protective chemical mixture (known as Bordeaux mixture) as an insurance against the attack of the disease. The mixture on drying, adheres to the nuts in the form of a thin film which being injurious to the fungus, protects the nuts from attack. A second spray done about six weeks after the first affords complete protection. Though the cost of such operation works out at a small figure of Rs. 10 per acre per spray including the proportionate cost of a sprayer, cost of chemicals and labour, and is but a small fraction of the income from the crop, the operation involves some trouble and a small initial capital. The result was that despite sufficient knowledge on these matters there was a tendency even among well-to-do garden owners to gamble with the weather and to think of spraying after the outbreak of the disease.

Following the severity of the disease in South Kanara last season the intensive, departmental propaganda done in the district since last December has been amply rewarded. A special staff of two agricultural demonstrators and 10 fieldmen assisted by 30 climbers scoured the areas well in advance of the monsoon and educated public opinion in favour of carrying out remedial measures. During May and early June, they held demonstrations on ryots' gardens in several centres. Every effort was made by the Deputy Director of Agriculture and the Government Mycologist to organise the sale of sprayers and chemicals to ryots through official and non-official channels. Special mention may be made of the efforts of the Puttur Division Mahali Prevention Co-operative Society which was formed during the year with the specific object of supplying sprayers and chemicals to a large number of ryots in Puttur and Kasargod taluks. The great demand for sprayers facilitated imports and encouraged local manufacture.

Results of Propaganda work. On a modest estimate well over 50 per cent of the 18,000 acres in South Kanara was sprayed well in advance of the monsoon and about 90 to 95 per cent. of the total area was sprayed before stray cases of disease appeared here and there. It cannot however be claimed that the spraying has been perfect in all details. The jet spray which has a longer but narrower range of action is generally preferred by ryots to the fine misty spray. This is a compromise, resorted to in order to save time and labour, but results in a larger consumption of the mixture and less effective protection. Again there is a tendency among some ryots to add far more lime than is necessary. Despite these defects, it is a matter for gratification that spraying has been done in the district in a measure never attained before. The disease has been kept in sufficient check though the heavy and almost continuous rainfall received between the middle of June and the middle of August would have been conducive to a general outbreak. But for the protection afforded, the plight of the areca growers could easily have been worse than what it was last year. The situation in South Kanara may be summed up in the words of a prominent land-lord who writes: "Our faith in the present measures has become stronger and we are trying hard to attain perfection".

The situation in South Malabar. South Malabar was fortunate in escaping the severity of the disease during the last three years. Consequently there was a general relaxation in spraying. Premonsoon spraying was not done to the

same extent as in South Kanara. The disease appeared in some villages in Ponnani taluk where ryots started spraying after the nuts began to fall away. This is a case of avoidable loss since ryots in this taluk are thoroughly educated in the methods of spraying and have time and again learnt to their cost the results of such neglect.

Eradication of nut grass, a troublesome weed. It is a matter of common knowledge that the presence of weeds especially the nut grass (*Cyperus rotundus* commonly called *Korai* (in tamil) or *Thunga* (in telugu) affects the growth of the crops and reduces their yield. It is found in all types of soils but thrives very well in sandy and loamy soils. Its propagation is chiefly by the nuts which develop underground. The nuts are connected by slender wire-like stems resembling a chain branching in all directions. A single *korai* plant sometimes contains more than 40 nuts connected to it. The chains of nuts are mostly found in the top layers of soil up to a foot or a foot and a half in depth. Sometimes the chains extend down to even 3 or 4 feet. The weed robs the plant food and moisture intended for the crop and smothers their growth also in the early stages. Once it makes its appearance, it spreads easily and persists under all conditions.

At Palur Agricultural Research Station it was once a serious menace to cultivation of crops. Various trials spread out over a number of years were made eradicating this weed. These trials can be grouped into two main classes; cultural and cropping.

Best results were obtained by ploughing the fields soon after the harvest and thence cultivating them with *guntaka* or spring harrow until the sowing period. Every time the implement was worked the germinated korai plants with the nuts were uprooted and dried in the sun. When fresh nuts from the bottom came to the top, again they were uprooted at the next working of the implement. That such a fallow cultivation had a wholesome effect in reducing the vigour of the weed was evident by the presence of a smaller number of nuts after the fallow season in almost all the fields.

In regard to the effect of cropping on the weed, it depended on the kind of crop grown. Sugarcane, fodder cholam and paddy under puddled condition arrested the growth of the nut grass almost completely. In cumbu and other drill sown crops reduction was perceptible due to frequent hoeing by bullock power while groundnut encouraged the increase of nuts as no intercultivation was practicable a month after its sowing.

It was also found that when the percentage of nuts under a two, three and four year rotation was worked out, the fields under 4 year rotation were much less weedy than those under the two or three year rotation.

From the above it is recommended that immediately after the harvest of the crop the field should be ploughed and *guntaka* should be passed once a fortnight to uproot and expose the nut grass. This should be continued till the time of sowing. A judicious rotation of crops which allows frequent intercultivation, is to be followed to effectively bring this pernicious weed under control.

Tomato Cultivation. Tomato as a vegetable has recently come to the forefront and the demand for the same is on the increase. People seem to realise value of vitamins in human nutrition and in view of its containing vitamins A, B and C in plenty, it should become more popular. As it contains very little fibre it is easily digestible and is also rich in protein contents. When ripe, it can be eaten raw and hence it serves both as a fruit and as a vegetable.

This vegetable can be successfully grown in all places and in all types of soils but sandy loams are preferable. On the plains, sowing can be started from June up to September. Again nurseries can be raised just after the north-east

monsoon rains are nearly over in December. The land should be heavily manured with well-rotten cattle manure and incorporated in the soil a month or two before planting.

There are many varieties of tomatoes and seeds can be obtained from any seedsman of repute. Three to four ounces of seeds are sufficient to plant an acre. The seeds may be sown in nurseries prepared as for ragi and the seedlings may be pulled out and transplanted when they are 25 to 30 days old. Ridges should be formed 3 or 3½' apart and the seedlings planted along the ridges 2 feet apart. Tomato plants have flexible stems and require artificial supports to grow erect. Stakes 5' or 6' in length may be driven 6 feet apart along the ridges and thin or split bamboos may be tied horizontally to train the branches. The soil should be intercultivated as frequently as possible to keep it free from weeds. Spraying with bordeaux mixture twice or thrice during the early stages checks diseases and acts as a repellant for several insects. Copious watering is quite necessary to get the maximum yield. It is better to allow the fruits to ripen on the plant itself, but for marketing it is advantageous to harvest the fruits when they are just ripening as they keep longer if done so. Under normal conditions the yield varies from 15,000 to 20,000 lb. of ripe fruits per acre. In villages near towns and cities, this vegetable can be cultivated and marketed easily. A net profit of about Rs. 150 to Rs. 200 can be obtained from an acre.

Market Surveys. The public are probably aware of a series of marketing surveys that are being conducted in this Presidency in line with the All-India Scheme to study the present marketing conditions of agricultural commodities and to suggest ways and means to improve them. All available statistics have been collected regarding production, consumption, net surplus, movements internal and external, trend of prices, methods of marketing, market and transport charges etc., of rice, wheat, linseed, groundnut, tobacco, fruits like oranges, pineapples, apples, and plantains, cattle, eggs, hides and skins and milk. These reports will be published shortly after they have been compiled and reviewed by the Agricultural Marketing Advisor to the Government of India, Delhi.

A few notes on some of the commodities surveyed may be of interest to the public.

Plantains. The average area under this crop in this Presidency during the last five years was 1,47,000 acres. The area has increased by 30,000 acres during the last 20 years. Nearly 35 per cent. of the area is in Malabar. It has, however, very little export trade. The annual estimated production in the Presidency is nearly 9 lakhs of tons of fruits valued at 441 lakhs of rupees. The largest exporting district is Trichinopoly which exports annually 5·5 lakhs of maunds of plantains by rail alone.

The maximum production of fruits is during December to March in all growing areas for *Poovan*—Telugu (*Karpura Chakrakeli*) April to July for *Rasthali*, October—November for Mauritius and throughout the year for hill plantains. *Nendran* is special to the west coast and the main season of its production is August—September.

The demand for plantains is mostly from the towns in this Presidency, Madras alone receiving by rail annually about 3·5 lakhs of maunds from many sources. The exports to other provinces and states annually amount to about 8,000 tons mainly to Mysore State and Hyderabad.

The prices of plantains were at their lowest during 1934–35. Prices have since improved slightly. For the *Poovan* variety there is a rise in prices during July to October and a fall from December to March when production is at the maximum. Mauritius fruits (*Pachavazhai*) show increase in prices in March—April and July—August. *Rasthali* shows a fall from April to May and a rise in July.

Of all the varieties, *Nendran* and hill plantains have the best keeping quality. *Poovan* comes next. *Rasthali* and *Chakrakeli* have poor keeping quality.

Although the export trade at present is only about 8,000 tons annually there is a large surplus for export if facilities are available. A large proportion of this surplus is at the mercy of the merchants and commission agents. Special railway rates exist from Trichinopoly plantain area to Mysore State; special wagon rates have also been introduced from Cauvery and Godavari areas for traffic by passenger trains to cities in North India. But still the rate works out to two to three times the cost of the plantains at the producing area and consequently the traffic to North has not improved.

The margin of profit between the different agencies engaged in plantain trade shows that the grower gets only 33 to 50 per cent. of the price paid by the consumers The retailers' profits are fairly—20 to 30 per cent. according to the variety.

There is thus a real need for the improvement and development of the plantain trade. A lot can be done in this direction by the producers organising themselves on the lines of the Fruit Growers' Association in California. This will certainly improve the trade and bring in more money. The marketing staff attached to the Agricultural Department, Madras, will render all assistance and guidance for the formation of growers' associations and in better methods of marketing and distribution of produce. Notes on other commodities will follow.

Gleanings.

Salt Prevents Ill Effects of Heat. A serious problem to many of the important industries of the country is the effect of extreme heat on employees. In mills and factories where of necessity high temperatures exist the problem of heat cramps and heat prostration is especially acute. Cramps and prostration however are frequently met with in hot months of summer where workers are unprotected from the direct rays of the sun and for that matter, even in mills where the temperature is lower than that of the outside air.

The use of salt as a remedy and preventive measure in such cases is several decades old, but only recently has its effectiveness been scientifically proved by successive trials. One of the most recent and thorough investigations of the value of salt as a heat prostration preventive was made by the Fatigue Laboratory of Harvard University, conducting experiments both at home and in the field. More than five years were spent in gathering data on the physiological and pathological effects of high temperature on workmen.

Dr. Arlie Bock, who is connected with the Harvard Fatigue Laboratory, suggests that a worker, working eight hours a day under extreme heat, should use plenty of table salt with his food and also should take five or six one gram tablets of salt, enteric coated to prevent dissolution before the tablet leaves the stomach.

Salt tablets solve prostration problems. Since salt tablets have been made available several automobile plants have not had a single case of heat exhaustion. The tablets each containing one teaspoonful of pure sodium chloride, are available at drinking fountains in many of the factories. They are swallowed whole, followed by one or more glasses of water. Holding that the principal cause of heat exhaustion is the loss of salt from the blood stream through profuse perspiration, Dr. E R. Harris, Physician at the Cadillac motor car plant is urging shop workers to take from 10 to a dozen of the salt tablets daily.—Henry C. Marble, M. D., Surgical Director, American Mutual Liability Insurance Co. (*Scientific American*, September 1937.)

Crop and Trade Reports.

Cotton Raw in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1937 to 7th September 1937 amounted to 449,926 bales of 400 lb. lint as against an estimate of 533,100 bales of the total crop of 1936-37. The receipts in the corresponding period of the previous year were 523,949 bales. 331,999 bales mainly of pressed cotton were received at spinning mills and 192,184 bales were exported by sea while 86,249 bales were imported by sea mainly from Karachi and Bombay. (Director of Agriculture.)

Ginger—First forecast report. The area under ginger up to the 25th August 1937 in the Malabar district is estimated at 11,000 acres as against 10,000 acres for the corresponding period of the previous year. The condition of the crop is satisfactory. (Director of Industries.)

College News & Notes.

Students' Corner. The college was closed for the Michaelmas holidays on 15—9—87.

Students' Club. Under the auspices of the Students' Club, Mr. K. N. Aiyah Iyer delivered a lecture on 6--9—37 on his experiences in Russia. Mr. R S. Sankara Iyer, Retired Dt. Judge, presided. There was a good gathering of students and officers to hear Mr. Aiyah Iyer's lecture which was much appreciated.

Games-Cricket. What turned out to be the most important match of the Y. M. C. A. Cricket tournament was played on the College grounds on the 8th September between the Agricultural College and the Coimbatore Cricket Club and ended in a victory for the college. Both the teams were well represented and a keen fight was anticipated. Winning the toss, the visitors elected to field. The College team lost a wicket before any run was registered but a good partnership between C. Ramaswami and C. N. Baboo changed the aspect of the game. The college were all out for 139 runs of which Ramaswami made 55 and Baboo 27. Thangavelu took 2 wickets for 27, Potts 3 for 62 and Muthuswami 3 for 16. The Club made a promising start but later dwindled down till fresh life was induced by some hectic hitting by Padmanabhan. They were all out for 113, of which Ward (22), Suri (19), Padmanabhan (19 not out) and Natarajan (18), were the chief contributors. The bowling honours were shared by Kodandaraman (4 for 34), C. Ramaswami (3 for 35) and Dinker Rao (2 for 34). The College is now leading all other teams in the tournament and stands the best chance for annexing the Shield.

Games Tour. The Cricket team of the College led by Mr. Shiva Rao has left on a holiday tour of Mangalore, Mercara and Tellicherry where they will be playing a series of matches against local colleges and clubs.

Our members abroad. We are glad to learn that Mr. V. Panduranga Rao, M.A., who went last year for special training under Dr. Weaver of Nebraska, U. S. A., has secured the M. Sc. degree of the University of Nebraska for his thesis on "Ecological Studies on the Roots of Sorghum and Millets". Mr. Rao is expected back in Madras in October '37.

ASSOCIATION OF ECONOMIC BIOLOGISTS, COIMBATORE. The following papers were presented at a meeting of the association held on 9th September 1937:—

Some experimental evidence for the origin of the indigenous canes of India. *By E. K. Janaki Ammal.* The indigenous cultivated canes of India, the so called *S. barberi* and *S. sinense* of Jesweit, occupy taxonomically a position intermediate between the noble cane *S. officinarum* and the wild species, *S. spontaneum*.

Cytologically these latter represent a polyploid series ranging from 2n=48 to 2n=80 in India (so far collected) and 2n=80 to 2n=124 in further India and East Indies. In *S. barberi* and *S. sinense*, aneuploid numbers ranging only from 2n-82 to 2n-124 have been observed.

Evidence for the origin of these canes from *S. spontaneum* has been obtained from (1) the study of occasional giant triploids amongst selfed progenies of *S. spontaneum* in which resemblance to *S. barberi* is very pronounced, (2) the occurrence of giant intraspecific hybrids from fertilisation of unreduced gametes in one of the parents, (3) from the phenomena of heterosis met with in crosses between widely separated chromosomal types of *S. spontaneum*, and (4) variation in sucrose content observed in populations of *S. spontaneum* seedlings.

The part interspecific and intergeneric hybridization might have played in the origin of some Indian canes is also presented by the study of their resemblance to such hybrids produced experimentally. (Author's abstract.)

The relative functions of the enzyme pectinase and oxalic acid in the parasitism of fungi. *By K. M. Thomas.* Workers on the physiology of fungi are divided in their opinion on the *modus operandi* of the invasion of the host by parasitic fungi.

The enzyme production of three fungi viz., *Botrytis cinerea*, *Sclerotinia sclerotiorum* and *Sclerotium Rolfsii* was studied with special reference to their capacity to produce oxalic acid. All the three fungi were found to produce a cell wall dissolving enzyme, but the enzyme of each showed specific differences in the wide variations of the optimum pH for their action. In the production of oxalic acid, *S. Rolfsii* produced the largest amount (2% on potato), *S. sclerotiorum* less, and *B. cinerea* only a trace. The amount of oxalic acid decreases with the increased acidity of the medium. The enzyme is produced and functions even when no oxalic acid is formed.

In the case of *S. Rolfsii*, the acid provides the suitable pH for the action of the enzyme. There is some evidence that the acid kills epidermal tissues and the unspecialised parasitism of *S. Rolfsii* is attributed to this character.
(Author's abstract)

Visit to the Imperial Cane Breeding Station, Coimbatore. The members of the association paid a visit to the Sugarcane Breeding Station on the evening of 23rd August 1937.

They assembled first at the Thick Cane Station where Mr. N. L. Dutt, the second Sugarcane Expert, received them and explained with the aid of interesting specimens the dual origin of sugarcane, viz., the thin-medium cane from India and the thick juicy canes from the South Pacific. With the help of charts he then explained the mass of data obtained regarding the germination and storage of sugarcane pollen, as also certain interesting studies on the seeds of thick canes. The members were then taken round the cane plots where the superior and vigorous growth of the thick seedling canes by the side of the standard varieties was marked. The most outstanding of these are Co. 419 and Co. 421, the former a 'thick cane' growing well in tropical parts of India and the latter a 'medium cane' giving a good account of itself in several parts of North India.

At the main station, Rao Bahadur T. S. Venkatraman, the Sugarcane Expert, received the party and explained to them the several ways by which mutations

in sugarcane could be induced artificially. They were shown a large collection of *Saccharum spontaneum* from all over India, which species of *Saccharum* was deliberately used at Coimbatore to produce vigorous seedlings. The encouraging results obtained by the crossing of sugarcane with sorghum gave a fillip to the selection of parents widely differing from sugarcane. Recently a successful cross has been effected between sugarcane and bamboo, and the members evinced great interest in the hybrid seedlings now growing in the seedling house area at the station. The hybirds exhibit several bamboo characters. The future of this cross will be watched with great interest.

Dr. E. K. Janaki Ammal, the Sugarcane Geneticist, then explained to the gathering the cytological evidence of the origin of several forms of *S. spontaneum* now growing wild in various parts of India and other countries and also how from such evidence she has formulated theories regarding the inheritance of certain characters in sugarcane.

Rao Bahadur T. S. Venkatraman and other members of the station were 'At Home' to the members of the association.

Weather Review—AUGUST 1937.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	6·5	-1·3	29·1
	Calingapatam	2·7	-5·2	17·5
	Vizagapatam	5·3	-0·1	16·8
	Anakapalli *	6 9	+1.6	26·7
	Samalkota*	5·9	+1·0	22 0
	Maruteru *	10·1	-3 4	19 9
	Cocanada	7 7	+2·2	24 9
	Masulipatam	6·5	-0·4	20·4
	Guntur*	3·7	-1·1	17·3
Ceded Dists.	Kurnool	1·0	-4·0	13·1
	Nandyal*	0·8	-4·4	19·0
	Hagari *	0·6	-1·8	6·2
	Bellary	0·4	-1·9	7·7
	Anantapur	0·9	-1·3	12·7
	Rentachintala	2·3	...	19·6
	Cuddapah	0·8	-5·0	10·6
Carnatic	Anantharajupet *	1·9	+1·0	15·2
	Nellore	1·6	-1·7	35·2
	Madras	7·1	+2·5	15·2
	Palur *	2 6	-2·8	9·3
	Tindivanam *	6·4	+1·7	11·8
	Cuddalore	2·6	-2·4	8·7
Central	Vellore	3·7	-2·6	14·3
	Salem	4·5	-2·3	16·3
	Hosur*	1 6	-1·4	20·8
	Coimbatore	2·3	+1·2	10·4
	Coimbatore A. C. & R. I.*	2·1	+1·1	13·6
	Trichinopoly	9·6	+5·8	21·1
South	Negapatam	2·2	-1·4	11·0
	Aduthurai *	4 6	+1·8	10·8
	Madura	4 5	+0·2	7·0
	Pamban	3 5	+2·8	14·5
	Koilpatti*	1·9	+0·1	9 6
	Palamkottah	1·2	+0·6	8·1
West Coast	Trivandrum	4·0	-0·1	37·7
	Cochin	12·9	...	97·0
	Calicut	11·2	-4·4	105·6
	Pattambi *	8·6	-6·9	66·3
	Taliparamba *	...	...	...
	Kasargode *	15·7	-8·0	141·7
	Nileshwar*	16·6	-9 1	131·2
	Mangalore	15·4	-7·1	122·9
Mysore and Coorg	Chitaldrug	1·5	-1·5	7·4
	Bangalore	2·3	-3·2	22 5
	Mysore	3·2	-0·2	22·2
	Mercara	23·8	-1·7	100·2
Hills	Kodaikanal	5·4	-1·6	30 9
	Coonoor	2·4	...	34·1
	Ootacamund *	5 8	-1·0	34·6
	Nanjanad *	5·5	-1·3	30·8

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in Fort St. George Gazette.

Summary of weather conditions. The monsoon continued active during the month except for a break from the 9th to the 17th, when the Arabian Sea branch weakened while the Bay of Bengal branch remained active.

Depressions formed in the Bay Area three times during the month were responsible for widespread rainfall. The monsoon was vigorous in Chotanagpur and the East Central Provinces ; strong in Orissa and Malabar ; active in Konkan, United Provinces, Bihar, South Bengal and Assam, the Central parts of the country and south of the peninsula while it was weak elsewhere.

Associated with a number of western disturbances thunder storm and showers occured in Baluchistan, North West Frontier Provinces, Kashmir, Punjab, United Provinces and Western Himalayas.

The skies were moderately to heavily clouded throughout the month. Humidity was slightly in excess in the North Madras Coast, and in defect in the South East Madras. The highest maximum temperature recorded was 113°F at Nokkundi on the 6th and 102°F at Madura on the 17th.

Rainfall was in slight excess in the South parts of the Carnatic and Central districts, and the Circars, while it was below normal in the West Coast, Mysore and Coorg and the hills.

Chief falls reported were :—

Mirzapur	6·5″	on the	1st.
Mahabaleshwar	5·0″	,,	1st.
Munar	5·3″	,,	3rd.
Cocanada	5·7″	,,	7th.
Mangalore	3·6″	,,	8th.
Trichinopoly	3·8″	,,	19th.
Masulipatam	2·4″	,,	21st.
Nileshwar	5·0″		
Tindivanam	3·3″		
Maruteru	2·3″		
Pattambi	2·2″		
Samalkota	3·8″		
Kasargod	6·3″		
Anakapalle	2·7″		

Weather Report of the Research Institute Observatory :

Report No. 8/37.

Absolute maximum in shade	91·5°F.
Absolute minimum in shade	68·3°F.
Mean maximum in shade	88·7°F.
Departure from normal	+ 0·8°F.
Mean minimum in shade	71·2°F.
Departure from normal	− 0·5°F.
Total rainfall for the month	2·1″
Departure from normal	+ 1·1″
Heaviest fall in 24 hours	1·3″
Total number of rainy days	4
Mean daily wind velocity	3·2 M. P. H.
Mean Humidity	74·5%
Departure from normal	+ 1·2

Summary. The monsoon was generally active during the month. The rainfall recorded was slightly in excess of the normal. The heaviest fall of 1·3″ was recorded on the 30th. The skies were moderately to heavily clouded. The mean humidity was slightly above normal. The mean maximum temperature was slightly above normal while the mean minimum was slightly below normal.

P. V. R. & F. L. D.

Departmental Notifications.

Dr. S. Ramanujam on return from leave to rejoin duty as Assistant, Paddy Section, Coimbatore.

The services of Mr. P. Satyanarayana, Assistant, Chemistry Section, Coimbatore, are placed at the disposal of the Government of India temporarily for appointment as second Assistant Agricultural Bacteriologist, Imperial Agricultural Institute, New Delhi.

Transfers.

Name of officer	From	To
Mr. A. Muhammad Ali	F. M. Palur	F. R. S. Kodur.
„ N. S. Rajagopalan	A. D. Darmapuri	F. R. S. Kodur.
„ N. Subba Reddy	F. M. Kcdur	A. D. Rayachoti.
„ M. Jeevana Rao	A. D. Siruguppa	F. M. Kodur.
„ M. Srinivasa Rao	A. D. Anantapur	A. D. Siruguppa.
„ N. Ramadoss Pantulu	A. D. First Circle	A. D. Second Circle.
„ P. A. Narayanan Nambiar	Asst. F M. Taliparamba	A. A. D. Calicut.
„ M. P. Sankaran Nambiar	A. D Calicut	A. D. Tellicherry.
„ R. Alagiamanavalan	A. D. Madanapalle	A. R. S. Palur.

Leave.

Name of officer.	Period of leave.
Mr. W. Thirumala Rao, Assistant in Chemistry, Anakapalli	l. a. p. for one month on m. c. from 1—9 -37.
„ P. Nagadhara Naidu, A. D. Bellary	Extension of l. a. p. for one month from 16—9—37.
„ P. Uttaman, Asst. in Paddy, Pattambi	l. a. p. for one and a half months from 16—9—37.
„ A. K. Ganesa Iyer, A. D. VI Circle	Extension of l. a. p. for one month from 18—9—37

ADDITIONS TO THE LIBRARY, AUGUST 1937

A. Books.

1. Soil Erosion and its Control. *Ayres, Q. C.* (1936). 2. Studies of Relations of Rainfall and Runoff in the United States. *Hoyt, W. G.* (1936). 3. Large Scale and Corporation Farming—A Selected List of References. *Colvin, E. M.* (Comp.). (1937). 4. Hardy Fruit Growing. *Keeble, F. & Rawes, A. W.* (1936). 5. Handbook for Farmers in South Africa. *Seymore, D. J., Ed.* (1937). 6. Agricultural Economic Facts: Base book of Iowa. *Soth, L. K.* (1936). 7. Rice and Rice Planting in the South Carolina. *Drar, D.* (1936). 8. The Chemical Composition and Nutritive value of Potatoes. *Whalley, M. E.* (1935). 9. Insects, Fungi and Bacteria Associated with Copra in Malaya. *Corbett, G. H., etc.* (1937). 10. Pests of Ornamental Garden Plants. *Wilson, G. F.* (1937). 11. An Economic Survey of Jamalpur Sheikhan (A Village in Punjab). *Bashi Ahmad, M.* (1937). 12. Southern India: Its Political and Economic Problems. *Slater, G.* (1936). 13. Incometax Enquiry Report, 1936. *Govt. of India Pub.* (1937). 14. The American Farmer and the Export Market. *Dowell, A. A. & Jesness, O. B.* (1934). 15. Problems in Marketing. *Learned, E. P.* (1936). 16. The Foods of a Hindu Village of North India. *Wiser, C. V.* (1937). 17. An Introduction to the Principles of Plant Physiology. *Stiles, W.* (1936). 18. Flora of Victoria. *Ewart, A. J.* (1930). 19. Recent Advances in Organic Chemistry, 2 Vols. *Stewart, A. W. & Graham.* (1936). 20 Enzyme Chemistry. *Tauber, H.* (1937). 21. The True Nature of Viruses (Animal Diseases). *Croften, W. M.* (1936). 22. Elementary Plane Surveying—Text and Manual. *Davis, R. E.* (1936).

B. Annual Reports.

1. Imperial Council of Agricultural Research Annual Report for 1936-37. 2. Imperial Dairy Expert Annual Report for 1935-36. 3. Administration Report of the Baluchistan Agency for the year 1st April 1935 to the 31st March 1936. 4. Report of the Botanical Survey of India for 1935-36. 5. H. E. H. the Nizam's Govt. Agri. Dept. Annual Report of Research and Experimental Work for 1933-34. 6. Indian Central Board of Irrigation Annual Report for 1934-35. 7. Indian Central Board of Irrigation Annual Report for 1935-36. 8. Imperial Institute Annual Report (England) for 1936. 9. United Kingdom Agri. Research Institutes Reports for 1934-35. 10. S. S. & F. M. S. Agri. Dept. Research, Economic and Agri. Education Branches Reports for 1936. 11. Kenya Coffee Board Annual Report for 1936-37. 12. Northern Rhodesia Agri. Dept. Annual Report for 1936. 13. Malta Agri. Dept. Annual Report for 1935-36. 14. Proceedings of the 56th Annual Meeting of the Hawaiian Sugar Planters' Association, 1936. 15. American Farm Bureau Federation Institute of Irrigation Agriculture 60th Annual Conference, 1937. 16. Purdue University Agri. Exp. Stn. Report of the Director for 1935-36. 17. New Jersey State Agri. Exp. Stn. 57th Annual Report for 1935-36. 18. Rhode Island 2nd Annual Report of the Dept. of Agriculture and Conservation for Tercentenary year of 1936.

C. Special Publications.

19. Forests in Relation to Climate, Water Conservation and Erosion. 20. Measurement of Irrigation water. (Dept. of Interior Bureau of Reclamation Pub.). 21. Report on Duty of Water Investigations on Citrus Cultivation at Gan Moshe, Palestine during 1931-32-33. 22. Field Experiments with Sugar Cane, VI. (British Guiana Agri. Dept. Sugar Bul. 6). 23. Proceedings of the First Meeting of the Board of Agriculture in Travancore, 1936. 24. Proceedings

Forty-First Annual Meeting of the Virginia State Horticultural Society. 25. The National Institute for Research in Dairying 1912--1937. 26. The Mineral Needs of Farm Stock. 27. Manuring for Profitable Production.

D. Bulletins, Memoirs Etc.

28 The Nutritive Value of Indian Foods and the Planning of Satisfactory Diets. *India Health Bull. 23.* 29. Calf Rearing. *Eng. Min. of Agri. & Fish. Bull. 10.* 30. A Preliminary Survey of the Grazing Land of Mauritius with Notes on the Cattle Industry of the Island. 31. Catechism of Co-operative Credit. *Mauritius Agri. Dep. Bull. 22, 46* 32. Investigations on the Associated Growth of Herbage Plants. 33. Investigations on "Spotted Wilt" of Tomatoes. *Com Australia C. S. & I. R. Bull. 105, 106.* 34. Cherry Pollination and Variety Investigations in New South Wales 1930-34. 35. The Occurrence of Plant Diseases in New South Wales. *N. S. Wales Agri. Dep. Sci. Bull. 55, 57.* 36. Pollination and Fruit Setting. *Missouri A. E. S. Bull. 379.* 37. Effects of Different Methods of Grazing on Native Vegetation and Gains of Steers in Northern Great Plains. 38. Drought Survival of Native Grass Species in the Central and Southern Great Plains, 1935. 39. Marketing Onions. 40. Incidence and Development of Apple Scab on Fruit During the Late Summer and While in Storage. 41. Seed Treatment Experiments with Oats Naturally and Artificially Inoculated with Smuts. 42. Irrigated Crop Rotations at the Huntley (Mont) Field Station, 1912-35. *U. S. Agri. Dep. Tech. Bull. 547, 549, 555, 563, 568, 571.* 43. Comparison of Various Chemical Quick Tests on Different Soils. *U. S. Agri. Dept. Misc. Pub. 259.* 44. The Philosophy of Co-operative Marketing. 45. Marketing California's Fruits Co-operatively. 46. Co-operative Cotton Marketing in the United States. *Wash. Pan. Amer. Union Dvn. of Agri. Coop. Ser. Nos. 1 2, 3.*

E. Circulars, Leaflets Etc.

47. Ants—How to Combat Them. 48. Managing the Dairy Bull. 49. Grape Pruning in Illinois. *Illinois A. E. S. Cir. 456, 460, 468.* 50. Good Varieties of Cotton for Missouri. *Missouri A. E. S Cir. 194.* 51. Principles of Bee-keeping for Beginners. 52. Chick Management. *Oklahoma Cop Ext. Work. Cir. 238, 268.* 53. The Control of Mosses and Lichens on Fruit and Nut Trees *Oregon Cop. Extn. Bull. 498.* 54. Biology of the Tobacco Moth and Its Control in Closed Storage. 55. Use of Soil-moisture and Fruit-growth Records for Checking Irrigation Practices in Citrus Orchards. 56. Production and Agricultural Use of Sodium Nitrate. *U. S. Agri. Dep. Cir. 422, 426, 436.*

F. New Periodicals.

1. International Review of Poultry Science.

Madras Agricultural Journal
(ORGAN OF THE M. A. S. UNION)

Vol. XXV] OCTOBER 1937. [No. 10.

Editorial.

The Russell Report. Readers of our journal will remember that in the cold weather of last year two eminent British scientists visited India at the request of His Excellency the Viceroy to inspect and report on the activities of the Imperial Council of Agricultural Research. Their reports have been submitted to the authorities and are now under their scrutiny. We have not seen the full report of Dr. Wright and would therefore confine this note to that of Sir John Russell. Although the terms of reference of this enquiry did not require them to go beyond the schemes subsidized by the Council, the experts, we find, have also scrutinised as well as their limited time permitted, the work carried on in the different sections of some of the provincial departments of Agriculture. If, as we have reason to suspect, anybody had any misgivings regarding the quality of work turned out by these provincial departments, misgivings based perhaps on the illinformed criticisms now and then given vent to in the press and from the platforms by persons who knew not what they said, the report now placed before the public should once and for all give the quietus to all such unnecessary apprehensions. There is a general tone of optimism running through the whole report regarding the lines of work in progress in the different provinces and in the opening chapter while reviewing the activities of the department as a whole from its inception to the present day Sir John observes "*The provincial departments have already achieved valuable results and have fully justified the confidence reposed in them from the outset.*"

The report is written in two parts. The first part deals briefly with the general agricultural practices and crops in India, the methods of improving crop yields, the difficulties in the way and means of confronting them and concludes with suggestions for the reorganization of the work of the Council and the Imperial Institute on lines suited for the carrying out of the recommendations made in the report. Part II deals with the various schemes subsidized by the Council.

The ultimate object of the enquiry being the improvement of the lot of the agriculturist, the report in part I deals fairly exhaustively with the present state of the Indian villages and the lines on which improvements may be effected. In the opinion of the expert "the improvement of village life is probably the greatest need in India today." And with this end in view he recommends that the activities of the Research Council may hereafter lie more in making wider and

fuller use of existing science than in developing new science for which latter purpose the Universities, in his opinion, are in the main the places for work. He feels that "there remains a great gap to be bridged between what can on present knowledge be accomplished and what is actually being done by the cultivators". An enquiry into the present methods of propaganda is recommended the more efficient of them to be finally accepted and widely used. Among the difficulties in the speeding up of Agricultural improvements "perhaps the most serious is the lack of an agricultural aristocracy and an educated agricultural middle class. Many of the great advances in Western agriculture are due to men of this type. In Great Britain an improvement effected in the experimental stations can be at once put into practice. Some large farmer is prepared to try it at his own expense.........Unfortunately India has nothing corresponding with this educated class. It is unfortunate that the colleges have been able to do so little in this direction.........In all my journeys I met only two or three college trained farmers". The other difficulties referred to in the report are too well known to us to need repitition here.

The Imperial Institute and its activities occupy the last chapter of part I. Valuable suggestions regarding the future of this institution "the purpose of which is to carry out investigations of fundamental importance to India in the same kind of way as is done at the Rothamstead Experimental Station or the Agricultural Research Departments at Washington" are offered. Regarding the staff of the Institute it is suggested "that the Director and heads of leading sections should, if possible, be men of international repute who would be respected for their own merits by workers at other institutions. The Director should be a scientist of wide repute.........need not be an agriculturist but should be distinguished in some science basic to agriculture." Sir John is convinced that it is not necessary to go outside of India to find a suitable man. As regards the Council itself the expert is of opinion that "during the short period of its existence the Council has accomplished a remarkable amount of good work and I do not see how its results could well be bettered." To those therefore who have been labouring under the false impression that the Agricultural departments in India are a sort of "White Elephants" the report of Sir John Russell should have come as a surprise—we hope none the less agreeable—and to those who have all along been the targets of uncharitable criticism, as a source of inspiration and encouragement in their future work. To conclude in Sir John's words, "the Indian ryot compares favourably with any of the peasant population I have met in different parts ot the world. The change from the ancient to the modern system took some seventy years to accomplish in the West. There is no occasion to despair of its accomplishment in India."

THE PLACE OF BOTANY IN AGRICULTURE.*

BY RAO BAHADUR D. ANANDA RAO, B. Sc., I. A. S.

Director of Agriculture, Madras.

Students of Botany, in fact, students of Natural Science are perhaps more fortunate than students of other branches of science, and especially students of Arts and Law, in that they come into daily contact with nature when they study plants—their flowers and fruits, insects, birds and animals of which Nature is so full. Those who come in contact with Nature constantly, see the great unseen hand that is responsible for the creation of universe and all that therein is. We come into contact with Nature through things created. A close study of either Botany or Zoology discloses to one the power, the glory and the majesty of the Creator. Need you, therefore, hesitate to call yourselves fortunate when your study brings you into close touch with Nature?

What is the connection between Botany and Agriculture? While Botany is a science which deals with all plant life in all its aspects, Agriculture is a science, an art and an industry—all combined, which deals with the culture of plants of economic value to man. A student of agriculture before he becomes a scientific farmer should know all he can about the plant—its inside so to speak—its relation to soil, to its environment, how it lives, what causes its illhealth, just in the same way as a mechanic should know his engine and the doctor the human body. Not only this, science is progressive, and the scientific farmer should constantly concern himself with the improvement of the plants in which he is interested. Do we not hear from day to day the so called "improvements" of the various models of motor cars—the new Minx, or the Ford 22 or the Flying Standard, etc. bringing to the notice of the public small points of difference between the old and the new to catch the fancy of the purchaser. Whereas in those concerned with crop improvement the object should not be and is not to "catch the fancy" of some one but to be of lasting benefit to the cultivator.

As students of botany you must have learnt that plants and animals are so different in their complex forms; yet such a difference ceases to exist in their simple organisation. You have also learnt that plants and animals have been derived from pre-existing forms by gradual modification and that there has been a gradual evolution from lower forms.

Those who have read Charles Darwin's *Origin of Species* would recollect how he points out the great variability that exists in plants, how nature reproduces itself to an extremely extravagant degree. For

* A lecture delivered before the Madras Presidency College Botanical Association.

a simple example take the *Margosa* or any road-side tree, and what constant struggle there is for existence and that in this struggle only those that suit their environment best are those that survive. The plant breeder of today who was the student of botany yesterday therefore takes advantage of some of these facts, e. g. of the great variability, and uses it for his own purposes. He looks into the variable mass of material of any particular crop like paddy, millet or cotton, and decides in his mind what kinds of plants suit him best. In the case of paddy, for example, he might look for plants with longest ear-heads and closely set grain or for those which produce ears earlier than others or for those with fine grains or for plants with many tillers or for those which have an erect habit or for those resistant to disease and so forth. He walks in the field examining individually hundreds of plants and selects a few which reach the ideal he has set before him. This process may go on for a number of days, and eventually when he makes up his mind how many he should have, he harvests them separately and keeps the produce of each plant separately till next year making a record of each, indicating briefly for what quality he has selected them. What he has stored is the produce of one earhead of a single plant. This he sows next year in single rows, and compares the progenies with each other as well as with the bulk seed of the crop from which he originally selected the single plants, the object being to compare one with another and with the original. Those which satisfy him he retains, others he rejects. The former he sows again in comparative plots and this process goes on for several years; eventually he may have only 2 to 3 % of plants whose seed he considers is better in different ways than the mass seed. This method of crop improvement is known as 'pure line selection' and each plant is given a distinguishing number and is called a strain. The produce of these strains he distributes to the cultivators and awaits results. In a large province like Madras with variations in climate and soil, it is impossible to expect any particular strain to do well uniformly. Therefore, he issues a number of strains in the hope of finding at least one or two which do better than others in any one locality. So that while he may have a number of strains doing equally well in a particular locality, some of these might behave entirely differently under another set of conditions. The task of the plant breeder is therefore not so simple or easy. It calls for a good deal of patience, optimism, courage and above all honesty, as the result of his work is to be j dged by a set of practically minded people,--people who know what they are talking about.

Let us go into a little more detail in regard to the objects the breeder has in crop improvement. Take the question of *yield*. Supposing a particular variety of paddy in a particular locality yields 2000 lb. of grain per acre. By his efforts which may have meant 6 to 7 years in

time, he finds that the strain selected from this variety had given by repeated tests 10 % more yield (i.e.) 2200 lb. as against 2000 lb previously. What benefit does this mean? In the case of an individual ryot, for every acre of the improved seed he grows, he would get an additional value of Rs. 5 per acre if it is reckoned that for a rupee you could purchase 40 lb. of paddy grain. Therefore, if one has 10 acres, he would obtain Rs. 50 more than before. In the Madras Presidency, there are at least 11 million acres of paddy. If such an improvement could be effected in all the varieties of paddy in the Presidency, it would mean that by this one improvement alone the ryots of the Presidency would get Rs. 55,000,000 annually more than they used to obtain before the introduction of the improvement. In fact, the improvement is as much as 30 % sometimes, but as a general rule, we can reckon on a 10 % increase in regard to yield.

Take again the question of *quality*. We have a strain of paddy known as G. E. B. 24 which has a very fine grain. It is a good yielder but is prized more for quality than yield. It is reckoned that it would fetch 4 to 8 annas more per bag than other varieties. If an acre produces 10 bags, the extra profit by growing this improved variety varies from Rs. 2½ to Rs. 5. So far, for profits that one obtains by plant breeding for high quality. Research is also undertaken to find out what factors are responsible for quality and whether the so called quality is desirable or not. Take, for example, the question of polished rice which educated and well-to-do people prefer to consume. Is it desirable to eat it? It has been shown that it is not as nutritious as unpolished rice, the reason being that in polished rice there is the absence of the aleurone layer in which there is an important principle called tryptophane which is necessary for animal diet. Similarly, in *ragi*, there are two varieties according to colour: white and brown. Which should we consume? Research has shown that while white *ragi*, has a higher nutritive value, the brown has a higher biological value.

There is also the aspect of the duration of the crop. Should the plant breeder look for plants which are earlier maturers or late maturers? In other words, should we look for plants whose life time is short? In a tropical country and in crops which mature by means of irrigation, it is desirable to have plants which ripen off early, as late maturing crops require more irrigation and are therefore more costly to produce. There are certain strains which are excellent as far as yields go, but they need a fortnight longer to ripen. This is indeed a defect from the view point of people who have difficulties for irrigation. On the other hand, if there is no such difficulty, a 15% increase in yield cannot be despised.

Take again the case of a very popular variety of Cambodia cotton called Co. 2 which is a high yielder but is a late variety. As a rainfed

crop, it would be advantageous to have one which matures early in tracts of deficient rainfall. Attempts are, therefore, being made to cross-breed it to obtain the desirable result.

I have just referred to the early and late maturing varieties of crops. This leads on one to the question of the minimum requirements of crops for water. Different crops require different quantities of water, e. g. paddy, sugarcane, and cotton. The same crop requires different quantities at different seasons of the year, e. g. dry months and rainy months. Again, the needs of different varieties of the same crop vary, e. g. sugarcane. From the point of view of crop improvement, it is desirable to have varieties which call for the minimum quantity of water without sacrificing the yield. A variety of sugarcane needs in the Vizagapatam District only one irrigation till the time of harvest whereas other varieties require 20 irrigations. This calls for the study of the root system of plants. When these are examined in a field where different varieties are grown, e. g. sugarcane, it is observed that roots of certain varieties go far deeply into the soil while others remain on the top regions. Further, observations of such varieties show that in a period of excessive drought, varieties possessing a deep root system withstand it better than their shallow rooted neighbours. Here, therefore, is the opportunity for one interested in the welfare of the agriculturist to develop varieties which are drought resistant and suggest to him those which he considers more advantageous, especially in tracts of precarious rainfall.

There are other directions in which a knowledge of Botany is so helpful to the scientific agriculturist. You have heard of fertilisation of plants by various agencies like wind, water and insects. To preserve the purity of his strain, the plant breeder takes steps to see that the plants he selects are self-fertilised, e. g. by bagging whenever necessary. On the other hand, he deliberately crosses one plant with another for the purpose of introducing into his strain certain desirable qualities. For example, you have two varieties of paddy—one is a heavy yielder but is susceptible to a particular disease, and the other though not so good in yield resists the disease. He crosses both varieties with a view to introduce into the blood of their progeny a quality of resistance without sacrificing the yield. We have in Tanjore now a disease resistant strain to a very serious disease of paddy called 'Blast' (*Piricularia oryzae.*)

Similarly, you have heard of parasites living on other living plants. *Striga* is a parasite living on the roots of certain cereal plants. Attempts are being made to evolve strains which are resistant to this parasite. By hybridisation or cross fertilisation, you can increase yield, remove weaknesses like lodging and disease, make plants withstand unfavourable conditions like alkalinity in soils, and resist drought, etc. You may have heard of the intergeneric crosses made

by Rao Bahadur T. S Venkataraman between sugarcane and sorghum with a view to reduce the age of cane from 11 months to 8 to 9 months. Similarly, we have, under trial, crosses in castor which have brought down the normal age from $8\frac{1}{2}$ months to 5 months. These are of great economic importance to cultivators. In Europe, horticulturists take advantage of this fact of crossing and produce flowers of great brilliance by combining certain colours. You are aware that potatoes are propagated from tubers. They are either cut or planted whole. Potatoes also form flowers and seed, but the latter is a very rare occurrence here. Careful attempts made in our potato farm at Nanjanad have enabled us to produce seed and we have now quite a number of varieties of potato from which fertile seeds have been obtained. We have quite a large number of seedlings obtained in this manner and from these, hybrid varieties have also been successfully produced which are better yielders and earlier maturers.

You have learnt in Botany that plants need food, air and moisture. There are, as you know, certain essential elements without which the plants will either die or do not thrive properly. This knowledge is very essential to the scientific agriculturist as this is the basis of manuring of crops. It is known that crops should have sufficient quantities of nitrogen, phosphoric acid and potash: a deficiency of any one or more of these will at once tell on the health of the crop or on the yield. Although the actual requirement of the crop for each ingredient can be ascertained by analysis of soil and the plant, experience goes a long way in helping the agriculturist to know what kind and what quantity of each should be applied to obtain a normal out-turn.

The plant breeder has also, however, to face the problem of deterioration and disease—deterioration because in the hands of the illiterate ryot the pure seed gets mixed with his old seed and all the trouble he has taken in crop improvement becomes a waste; the department has therefore to concern itself in seeing that such mixtures are removed and the purity maintained as far as possible. In regard to disease, their number is legion. I shall not trouble you with what these diseases are and what is being done in regard to them, but I would like to illustrate one or two interesting instances from the point of view of students of Botany. There is a serious insect pest called 'stem weevil' in cotton which bores into the stem and makes the plant to fall down and in extreme cases kills it. Certain types of the cotton plant however, stem the onslaught of the insect by exuding a gum to cover over the damaged part and thus arrest the progress of the insect.

It is not my desire to take you into the several ramifications of this entrancing subject. I have, I hope, been able to show you how a knowledge of Botany is not only helpful but also necessary for the

scientific agriculturist and what the department of Agriculture does in the direction of crop improvement for the benefit of the ryot with the knowledge of Botany it has in its possession. If Botany is studied from this point of view, I am sure you will agree with me, that the study will not only be interesting but is worth all the trouble you take in mastering it, because it would help to improve the lot of a class of people who need our help most.

HE STORY OF TEA

BY S. DORASWAMI AIYAR, B. A.,

Assistant, Messrs. Parry & Co., Ltd., (Fertiliser Dept.).

Tea is probably the most popular beverage in the world, the total consumption being some hundreds of million pounds per annum. The cultivation of this plant has enabled thousands of acres of what had been, for many centuries, waste land in many countries to be converted into valuable plantations; and the cultivation of the plant, the manufacture of tea and the commerce in tea have given lucrative employment to thousands of people.

The principal countries consuming large quantities of tea are China, Japan, the United Kingdom, the British Colonies, Russia, the United States of America and the Netherlands. The consumption in some European countries, particularly, Germany, France and Denmark and in the Asiatic countries, principally, India, Tibet, Burma and Persia has been increasing. The principal countries producing tea are China, Japan, India, Ceylon and Java.

Tea in China. Tea was known to the Chinese from very early times, even many centuries before Christ. The Chinese names for tea, *Theh* or *Tha* and *Tcha* or *Cha* occur in several ancient literary works. The word *ming* was also used to denote tea. It is said that in the middle of the fourth century A. D. Wang Meng, the father-in-law of the then Emperor, was fond of drinking tea but his friends found it to be too bitter, and that a later Emperor, Wen-ti (589—605 A. D.) was recommended by a Buddhist priest to drink boiled *ming* leaves as a cure for headache. For some centuries tea was probably used only as a medicine. It was only in the 6th or 7th century that it came to be used as a beverage. The use of tea as a beverage should have been so general in China in the 8th century that a duty was imposed on it for purposes of revenue. About the year 850 A. D. an Arab merchant who travelled in China has mentioned in his account of travels that the people of China were accustomed to the use of tea as a beverage and that the leaves were being sold in all towns.

The cultivation of tea began to increase from the 9th century and considering the enormous population and the widespead consumption

of tea among the Chinese, China must be considered as the chief tea-producing country in the world. In fact "China" and "Tea" have been inseparably associated. In China, tea is grown mostly on small farms of even 4 to 5 acres each. It is said that practically every cottager has his own little tea garden to supply the wants of his family and any surplus is sold. Tea estates or plantations, as we understand the terms, are very few. The methods and appliances employed by the Chinese in the manufacture of tea are very simple and practically the whole of the manufacture is carried out by the hand.

For centuries, the Chinese have been making "black tea" and "green tea". It was supposed that these were products of two species, *Thea bohea*, producing the black tea and *Thea viridis*, green tea. It was only in the middle of the last century that it was established that the question of green and black teas, as also the various qualities of these, was a matter of soil, age of leaf used and method of manufacture, and not to there being two botanically different species. In the Russian and North American markets green tea has been in demand and as the green tea prepared by the Chinese lacked the vividness of colour, artificial colouring of green teas was practised. Gypsum and Prussian blue are the most commonly used for this colouring or "facing" as it is called. The colouring is effected by thoroughly mixing the tea with a compound of calcined gypsum and Prussian blue. From 1911, however, the American market was closed to such artificially coloured teas. It is said that the Chinese themselves never use the artificially coloured teas.

Teas for home consumption and for the Chinese community abroad are often scented. Finished tea has the property of absorbing odours and the fragrant flowers of jasmine, orange and roses furnish the perfume. The flowers are moistened and mixed with the tea in varying proportions and the two left in contact for 10 to 14 hours, the heaps being covered with a cloth. The tea rapidly absorbs the perfume. The flowers are removed and the scented tea is then blended with unscented tea, the mixture being perfumed throughout.

For a very long time China was having a good overland trade in tea with Tibet, Siberia and Russia. In the absence of roads tea had to be carried on men's backs and so it was an advantage to have it in as compact a form as possible. Consequently the manufacture of "brick tea" became popular from very early times. Besides the compactness there is also the advantage that the quality and character of the tea are better preserved. For Tibet the brick tea is made from very cheap and coarse teas, including even stalks and twigs, and for Russia, "tablet tea" or small bricks are made using green and black tea dusts. The bulk of the dust used for these is of Chinese origin but during the past few years large quantities of siftings and dust are imported from India, Ceylon and Java.

During the past few decades the export trade of tea from China has been declining owing to the increase in production in other countries, particularly, India, Ceylon and Java and owing to the change in the taste of the people, particularly of the British Isles who prefer Indian and Ceylon teas to the Chinese. In 1864 the proportion of China tea in the world's exports amounted to 97%, while in 1911 it was only 24% and at the present time it is still lower. There is, however, a steady market for China tea in Russia and Tibet.

Tea in Japan. There is an interesting legend about tea. Dharma, a celebrated hermit, held in sanctity in Japan and China, was doing severe penance and had remained seated on the hard ground fourteen years without moving his body. He had also forbidden himself sleep. One night, however, he fell asleep. Indignant with himself for this weakness he cut off his eyelashes and cast them away, "as miserable tempters, sullying the sanctity to which he aspired." It is said that his eyelashes took root in the place where they had fallen and a bush shot forth, bearing leaves which the people of the country picked, and whereof they made an aromatic infusion which chases away sleep.

There is no doubt that tea was introduced into Japan from China in the ninth century. Its cultivation on an appreciable scale probably took place in the thirteenth century. As in China, tea is grown in small plots by peasants but there are also some large plantations. The Japanese exercise greater skill in cultivation and manufacture of tea than the Chinese. The methods of manufacture are more improved and machines of a simple type are largely used. The tea produced in Japan is the green tea. The principal markets for Japanese tea are Canada and the United States.

There are some peculiarities in the cultural methods adopted in Japan. Tea is frequently grown in continuous hedges, a few feet apart, and not in separate bushes as in other countries. This method is said to result in heavy crops. Instead of pruning the bushes, they are clipped with shears after the main plucking. In the Uji district there is the remarkable practice of growing tea under artificial shade, the effect being the production of a better quality of leaf and of a darker green colour. Bamboo poles are fixed at intervals and arranged to support a suitable frame-work, over which bamboo mats or straw are spread. This provides shade to the growing plants. After the crop has been plucked the matting and straw are removed. The shade grown tea is greatly valued by the Japanese and it is grown practically for home consumption. Tea is often grown interplanted with mulberry, plums and pears. It is said that the area under tea has been declining owing to the greater interest taken in mulberry plantation.

Tea in Formosa. Cultivation of tea was introduced into Formosa early in the nineteenth century by some Chinese immigrants. But it was only in the seventies of the last century that tea planting was

carried on extensively. Like China and Japan, most of the tea gardens in Formosa are small and owned by peasants. The most noticeable feature in the cultivation of tea in Formosa is the practice of layering adopted on a large scale. It is said that nearly three-fourths of the tea grown in Formosa have been raised not from seed but from layers. It is believed that propagation by layering retains unimpaired the specific qualities of the tea and that deterioration sets in if the plants are raised from seed. Formosa produces the famous "Oolong teas" which have a distinctive flavour and possess a great reputation, especially, in the United States.

Introduction of Tea-drinking in Europe. There is no doubt that tea drinking was very common in the 16th century in China and Japan and that China must have had considerable export trade in tea for a very long time. In all probability Russian traders might have been the first to introduce tea in Europe. The first treaty between China and Russia was made in 1590 but no mention is made of tea in it. It is said that the Chinese Embassy took some chests of tea as presents to the Russian Court and that the Czar was so pleased with it that he sent a special messenger every year to the Chinese frontier to obtain a supply.

The use of tea had spread to the East Indies from China and Japan. It was conveyed to Holland by the Dutch East India Company. From Holland it was carried to England about the middle of the seventeenth century. In the *Mercurius Politicus* of September, 1658, there was an advertisement of the "China Drink called by the Chineans *Tcha*, by other nations, *Tay* alias *Tee*" as being sold in London. Thomas Garway was the first tea-dealer in England and in 1659 and 1660 he sold tea at prices varying from 15s. to 50s. per lb. In 1660 tea drinking was so general that an Act of Parliament imposed a tax of 8d. on every gallon of tea, coffee and chocolate made for sale. There is an entry in Samuel Pepys' diary for the 28th September 1660 which reads "I did send for a cup of tea (a Chinese drink) of which I had never drunk before" and "Home, and there find my wife making of tea, a drink which Mr. Pelling the Pothicary tells her is good for her cold and defluxions".

The East India Company began to take interest in tea. In 1664 the Company presented King Charles II with two pounds and two ounces of tea. The first importation by the Company was in 1669 and it consisted of two cannisters containing 150 lbs. In 1677 the Company had taken steps to secure regular supplies, the total quantity imported that year being 4,713 lbs. and it was at that time thought worth their attention as a branch of their trade, as tea was then sold in London at £ 5 to £ 10 per pound. The supplies of tea were got *via* Madras and Surat and not direct from China.

The annals of the East India Company record that in February 1684 the Directors wrote to Madras in these terms :— "In regard *thea* is grown to be a commodity here, and as we have occasion to make presents thereof to our great friends at Court, we would have you yearly to send us five or six cannisters of the very best and freshest that which colours the water in which it is infused most of a greenish complexion is best esteemed."

The import of tea was a private monopoly of the East India Company. The imports began to increase steadily and in the closing years of the seventeenth century it was said to average about 20,000 lbs. a year. In 1703 the imports were about 100,000 lbs.; in 1721 it attained 1,000,000 lbs. It is said that during the 100 years from 1710 to 1810 the sales of tea by the East India Company amounted in the aggregate to 750,470,016 lbs. valued at about £ 130 millions sterling.

By an Act of Parliament the monopoly of the East India Company was abolished in 1833 and since then owing to unrestricted trade, competition was stimulated and prices fell greatly. At the same time the taxation on tea was also gradually reduced. As a result of all these the consumption of tea increased. In 1836 the consumption was about 40 million lbs. while in 1880 it had increased to 160 million lbs. and at the present time it is about 500 million lbs.

Tea in India. On account of the very profitable nature of the monopoly of the China tea trade enjoyed by the East India Company, the question of growing tea in India did not present itself to the Company for several decades. Difficulties with China induced the British Government to urge strongly on the East India Company the desirability of raising tea in India. In 1780, seed was got from China and planted in Calcutta by Captain Kyd. But no progress was apparently made. In 1788, Sir Joseph Banks made a suggestion to Warren Hastings that tea might be grown in Bihar, Rangapur and Cooch-Bihar but the suggestion was not acted upon for some years. In the meanwhile, between 1821 and 1826 tea plants were discovered by Major Bruce and Mr. Scott in parts of Assam and Manipur. But serious attention was not paid to these discoveries. In 1834, Lord William Bentinck took up the matter and appointed a Committee to report on the most hopeful situations for an experimental cultivation of tea. Mr. Gordon was sent to China to procure seed and plants and to bring to India a few Chinese growers. In the meantime, the wild tea of Assam was re-discovered by Jenkins and Charlton. Gordon was therefore recalled from his voyage to China. A Commission was sent to Assam to report on the indigenous tea. They could not agree as to the plant met within Assam and they recommended that for the purpose of the experiment "the China plant and not the degraded Assam plant" should be used. Gordon was sent again to China but he resigned without making a report.

A third mission was sent to China under the guidance of the botanist, Mr. R. Fortune, expenses of which were partly borne by the Royal Horticultural Society of England. The mission was successful. The true nature of black and green teas over which there was a controversy for many decades was explained. Mr. Fortune wrote three valuable books which contain full particulars of the Chinese tea industry and also details of the seeds, plants etc. conveyed by him to India. Experimental plantations were laid out in the district of Kumaon, in the Himalayas, and in Assam. The Government gradually ceased to take direct interest and the plantations were made over to private enterprise. The Sibsagar plantations were sold to the Assam Company in 1840 and this is the first tea concern in India.

The first consignment of Assam-made tea was sent to London in 1838 and it consisted of 488 lbs. and it fetched a price of 9 s. 5 d. per lb. This was manufactured under many disadvantages and consequently it did not afford any fair criterion as to what the possibilities of the future would be. The report of London experts was quite satisfactory although the tea had different characterisitics from those of China teas. The *Asiatic Journal* of those days had the following remarks about the British Indian tea.

" The decision of the public, however, has not been unanimous. Ladies particularly those of mature age and judgment, whose jurisdiction in all matters connected with the tea-table ought not to be disputed, were enthusiastic in their praises of the new tea, but many of the lords of creation, especially stout gentlemen, whose previous habits had better qualified them for discussing the merits of port wine and bottled porter, compared it somewhat irreverently to chopped straw, and some pleased to display their facetitiousness by observing that a mixture of gunpowder was wanted to make it go off ."

In the fifties of the last century tea cultivation appeared to be so promising and attractive that speculators eagerly rushed into it. In a few years the whole of the upper portion of the province of Assam was under tea. Tea planting extended to Darjeeling, Chittagong and Chota Nagpur. It also began to extend to the Nilgiris, Wynaad and Travancore in South India.

From the seventies tea cultivation has been making good progress. The total production of tea in India is over 500,000,000 lbs. annually. The production in S. India alone is 65,000,000 lbs.

During the past ten years the production of tea in all the tea-growing countries had exceeded the demands and consequently prices fell so much that tea growing appeared to be unprofitable. In order to stabilise the industry there has been, during the past five years, an international agreement to restrict production and to control exports. This has worked so well that the industry has again become a fairly profitable one.

An interesting feature of the tea industry in India is the organised efforts of planters to increase the sales of their tea. For this there is a cess fund. At first this was a voluntary levy on the planters coupled with a contribution from the Government for the purpose of advertising Indian tea. This was done from 1893 to 1903 when a Tea Cess Act was passed making compulsory a small tax on all exported tea. The fund is administered by a representative committee and it is expended on many forms of advertisement both in India and abroad in order to enhance the demand for Indian teas. Considerable success has attended these efforts in the United States and Russia and in some countries of Europe. Consumption of tea in India itself has increased on account of this advertising. In South India alone, the consumption of tea was 4,027,107 lbs. in 1925 and 13,876,268 lbs. in 1936.

Tea in Ceylon. Up to the middle of the last century coffee cultivation was the most important in Ceylon, but, in the sixties, a terrible fungous disease (*Hemileia vastatrix*) ravaged the coffee plantations and in a few years the "leaf disease" had ruined many plantations. The planters turned their attention to other crops such as cinchona, cardamoms, cacao etc. but without much success. Then they turned their attention to tea and this retrieved their position. In fact, the modern tea industry of Ceylon was built upon the ruins of coffee-planting.

Although tea had been planted in Ceylon in 1839 and 1841 the first regular plantation was opened only in 1867. For a few years the increase in acreage was not very marked but from 1877 it began to increase rapidly. In 1877 the acreage was only 2,720; by 1887 it had come to 170,000 and in another decade to 350,000. Now there are 450,000 acres under tea in Ceylon. Some of the plantations are interplanted with rubber.

Tea in Java. Tea was introduced into Java by von Siebold in 1826. In 1828 the Dutch Government assumed control of the industry and established plantations which were let out on contract system whereby the finished tea was sold to the Government at a fixed price. This system did not work satisfactorily as contractors cared more for the securing of large quantities of tea while the quality of tea and the permanent well-being of the plantations were not cared for. The contract system was therefore abolished in 1860.

In 1852-53 Jacobsen imported better seed from China and practically laid the foundation of the modern tea industry in Java. In 1878 the "Assam Indigenous" variety was imported from India and from that date the Chinese tea has been replaced by the Indian tea. The climate and soil conditions are favourable. The average yield is very good but the quality is only medium. In Java modern machinery and methods are adopted for the manufacture of tea. From 1890 the industry has been expanding rapidly. Holland is the chief market for

Java tea but exports are made to Australia, the United Kingdom and Russia.

Tea in other Countries. In Africa, tea is produced in Natal and Nyassaland. It is, however, not of much importance. The bulk of the production is consumed locally. In Russia, tea is grown on a small scale in the Caucausus. Chinese varieties are found to be the best suited to the country. Tea-growing in the United States has been the subject of experiment for nearly a century. There are a few plantations in Carolina and Texas. Tea is grown on a small scale in Jamaica. It has also been grown in several localities in the Malaya. In Malacca and the French colony of Annam tea is grown to some extent. Small quantities are also grown in Mauritius, Fiji and the Andamans.

In Burma and the Shan States a peculiar form of tea is prepared known as the "Letpet" tea which is only consumed locally and not exported. It is used as a vegetable and only rarely used as a material for infusion. The young leaves are thrown into boiling water and allowed to remain for some time to get softened. They are then taken out and rolled by hand and then rammed down tight into the hollow of a bamboo and the top closed with a stopper of leaves. After standing in the shade for a couple of days with the stoppered end down, to drain off any water, the stopper of leaves is removed and the portion above the rammed in leaves is filled in with ashes mixed with a little water. The bamboos are buried underground until the "letpet" has matured. The tea pickled in this way is eaten with a little oil, garlic, fish, etc.

Other Teas and Tea Substitutes. Among the other "teas" the most important is the "Paraguay tea" or "Yerba de Mateē". This is prepared from the leaves of *Ilex paraguariensis* a shrub belonging to the holly family. It is found commonly in Brazil and Paraguay and in these countries it is also cultivated on a large scale, even as regular plantations. It is one of the most important economic products of South America and several million pounds of *mate* are used in the S. American countries and in small quantities even in Europe.

The "black drink" of the North American Indians known as "Youpon" is prepared from *Ilex cassine* found in the eastern and southern shores of the United States, for some distance inland.

The "Bushman tea" of South Africa is prepared from *Cyclopia genistoides*. "Bourbon tea" known also as "Faham tea" is derived from *Angraceum fragrans* which is found growing as an epiphyte on the trees of the forests of Bourbon and Mauritius. The green leaves of this have a persistent vanilla-like odour.

During the Great War many substitutes for tea appeared. It is said that a "*German Tea*" was prepared in 1917 by the consumers themselves and consisted of mixtures of leaves of myrtle, raspberry, strawberry plant, bramble, flowers of the lime, of heather, woodruff and camomile. The fruits of wild rose, apple peelings and dried apples were made use of. A special brand of tea consisted of "a chopped mixture of the flower of lavender and elder, liquorice root, leaves of coltsfoot, of the strawberry plant, of bramble, birch and water mint."

ROLE OF INSECTS IN RURAL RECONSTRUCTION

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Introduction. It is proposed to place before you a few items of work which could find a place in any programme of rural reconstruction, viz., beekeeping, Eri silkworm rearing, control of crop pests and sanitation. These subjects will show the part played by insects in rural reconstruction. They have been specially selected as the Entomological section is doing work in this direction.

Beekeeping. It will be admitted by every one that the lot of the ryots in these days is not an enviable one. The income from agriculture being poor, he has to look to other avenues to enhance his earnings. Beekeeping on scientific lines offers great scope as a cottage industry.

In the limited time at my disposal it is not possible to describe in detail the habits of the honey bees, how the different members of the colony are produced, their varied duties and the perfect organisation of a bee colony. I think, however, a few words should be said about the advantages of beekeeping as a subsidiary industry. In the first place this industry does not require much capital and this is a point in its favour especially in a country like India. A few hives and a honey extractor are the only important appliances needed for starting beekeeping and these require only a small outlay. A teakwood hive costs only Rs. 3 to 3—8—0 and a honey extractor depending on the size and metal used costs from Rs. 2—8—0 to Rs. 9. The small extractor costing Rs. 2—8—0 devised by the section is quite enough for a ryot owning a few hives. A hive is capable of yielding 15 to 20 lbs. of honey under favourable pasturage and weather conditions. Even if the average is taken only as 6—7 lbs. at the present price Rs. 7 to 10 may be got per hive per annum. It will thus be seen that this industry is a profitable concern.

In the second place, in many parts of our Presidency there is no dearth of bees or bee pasturage. The Indian bee can be procured without much difficulty. The bee paturage plants are also available in most of the districts throughout the year.

In the third place, the training required in beekeeping is not of a complicated nature. A working knowledge of the various items in the management of bees such as catching swarms and wild colonies, fighting against bee enemies, care of the colonies during the lean as well as the breeding seasons, extracting and storing honey, etc., can be gained in about a month. It is always safe to begin with a few colonies and increase them later on after gaining more experience.

Apart from giving us honey the bees are good pollinators and this is an additional reason for rearing bees. This aspect of their good work is not realised by many. The fruit grower and the florist have to depend mainly on insects for their pollination and among insects honey bees are the best.

Yet another reason why beekeeping should be practised is that honey is a good food in itself and also of medicinal value. Miss Kennedy Bell, an authority on beekeeping and one who was chosen by the British Broadcasting Corporation to deliver a course of lectures on beekeeping states as follows about honey.—" Honey is not and should not be considered as a luxury. It is a first class food and should be used as daily article of diet by every family ; it has been predigested by the bees and hence its purity and excellence. Cane sugar is actively poisonous to many people if it is taken in any quantity and to all if taken in large quantity ; but honey acts as normal producer of heat and energy. The value of honey cannot be over-estimated for children, invalids and aged, also for the ordinary hardworking man and woman. It is an easily assimilated food and as it is predigested by the bees it is of special benefit to weak digestive organs of elderly people. Every body can eat honey with impunity and digest it when often he cannot touch any other sweet food ." Honey is also said to have medicinal properties and some of the publications on *Ayurveda* bear testimony to this fact.

There is yet another product of the honey bees, namely, wax. In scientific beekeeping, however, the wax combs are used over and over again for rearing brood and storing honey. It is not destroyed as in earlier days when honey had to be squeezed out of the combs.

After having stated the advantages of beekeeping, let me very briefly narrate to you the work of the Department under three heads—research, propaganda and training.—At the instance of the Director of Agriculture, Madras, an Apiary was started by the Government Entomologist during 1931 and there are at present about 40 bee colonies in working condition. The more important of the various items of research consist of the study of bee pasturage plants, bee enemies and their control, artificial feeding of bees, trials of range of flight, acclimatising the hill bee on the plains, bee appliances, etc., and very interesting results have been obtained from these lines of investigations. In addition to research, a good deal of propaganda is also being done by the section and the district staff. Demonstrations in hiving bee

colonies, and in the care and management of bees, etc., are being held in different parts of the Presidency. Bee colonies, samples of pure honey as well as the necessary apicultural requisites are being exhibited in most of the exhibitions and fairs and these, as a rule, attract numerous visitors—Attempts are also made to sell as many hives, extractors, etc., as possible to the public. Literature on bee-keeping—scientific as well as popular—is being published. To meet the numerous demands for advice from the public a popular account of the subject was prepared by Mr. S. Ramachandran, Assistant in charge of the apiary and published as bulletin No. 37 of this Department and a revised second edition of the same has already been issued. A Tamil translation of the above bulletin is also being got ready. As these are priced publications a short pamphlet on "Practical hints on beekeeping" has been prepared recently and sent to the press. Special mention should also be made of the "Honey Week" organised by the Section in April last and conducted throughout the Presidency. In addition to research and propaganda, about 25 students are trained every year in the theory and practice of bee culture. Besides these students, 27 departmental officers were trained during last year and it is hoped that these officers will try their best to popularise the industry in their respective sub-circles.

Ericulture. The silkworms are yet another of the useful insects. The two important worms in this Presidency are the Mulberry and Eri silkworms, and as there is a paper on the former by Krishnamurti* a few facts about the latter alone are given here. Ericulture has also some scope as a cottage industry. The worms are fed on castor leaves. The silk produced by them though not as good as mulberry silk is stronger, finer and more durable than cotton. Unlike mulberry silk, the thread is not continuous and as such it should be carded and spun like cotton.

The acreage under castor in this Presidency is about three lakhs. As the crop is grown by many ryots there will not be any dearth of food plants. The climatic conditions are such that the worms can be reared in many places throughout the year except for two or three months during the hot season. The necessary rearing appliances are not costly either as these consist of a few bamboo trays for rearing worms, a few baskets for placing the mature worms for spinning cocoons and a shelf for keeping rearing trays. The worms are fed at regular intervals but feeding them is not a difficult process. One advantage in the rearing of eri worms is that no life is taken and the moths are allowed to come out of the cocoons. This is not so in the case of mulbery worms where the thread produced is a continuous one and as such the pupae will have to be stifled to prevent the thread being broken by the emergence of adult moths.

* *The Madras Agricultural Journal*, 25; 239—244 (1937).

Now a word about the economics of ericulture. An acre of castor yields between 6000 and 8000 lbs. of leaves. About 80 lbs. of leaves will be required to feed sufficient worms to produce 1 lb. of cocoons. Taking 6000 lbs. of leaves per acre we get 75 lbs. of cocoons. One maund (82 lbs.) of pierced cocoons sells at Rs. 55 to 60 in Assam.* It should, however, be stated that one drawback at the present time is that there is no market for cocoons in Madras. The Industries Department when addressed on the subject has stated that in case the silk is spun into cloth they will try to find a market for it. Perhaps the formation of co-operative societies for the purchase of cocoons and spinning cloth will solve the problem.

Control of Crop Pests. Till now we have been dealing with insects which help us in rural reconstruction. It should, however, be remembered that there are many insects which devastate our crops and are thus our enemies. The work of the Entomologist is a continuous struggle against these marauders but thanks to the researches into the life histories and habits of these insects it has been possible to cope with many of them. Especially is this so in the case of kitchen garden crops grown in villages near important towns. In such places there is great scope for growing vegetable crops and flower plants. Pests, such as plant lice on lablab, *Epilachna* on brinjals, *Papilio* caterpillar on curry leaf, the cabbage caterpillar (*Plutella*), cockchafer beetles on roses, the jasmine bug, the chrysanthemum caterpillar, etc., can be dealt with by agricultural, mechanical and insecticidal methods and as such the growing of the crops should prove to be a remunerative concern.

Sanitation. It is a well known fact that insects are very important in connection with disease. Malaria, yellow fever, filariasis, etc., are transmitted by mosquitoes. Sleeping sickness, a terrible disease prevalent in Africa, is transmitted by tsetse flies. Fleas have a great part to play in the spread of plague, and bedbugs are accused as carriers of Kala-azar fever. The house flies are responsible to a great degree for the spread of diseases like typhoid (enteric), dysentery, cholera, tuberculosis and diarrhoea. Howard, the well known entomologist, in one of his publications, states that the house flies should be known as typhoid flies, so as to focuss the attention of the public on these extremely dangerous insects. There is no exaggeration in saying that house flies are the filthiest of insects and their habits the most disgusting. They breed in all sorts of filth, human excreta, decaying vegetable and animal matter, manure heap, etc. They feed on the matter contaminated with germs and then settle on our food and infect it with germs carried on the different parts of their body. It has been found by examination that six million germs have been carried by a house fly. I am sure every one will agree with me that

* Messrs. Haribuksh Lachminarayan, Fancy Bazar, Gauhati will be willing to purchase cocoons at the above rates, Gauhati delivery.

the flies which carry such huge numbers of germs are a danger to public health, and those who kill them should be regarded as good citizens doing service to humanity in general and to themselves in particular. Some work has been done in connection with the control of house flies by the Entomology section. The use of what are known as 'Minnesota' and fly maggot traps has given some measure of success. The former devised by Washburn for trapping adult flies is about 2 ft. long, 1 ft. high and 8″ wide. It consists of three portions, a base board with two bait pans, another board which carries two wedge shaped structures having wire gauze sides open at the top and bottom and a wire gauze cover for encapping the adult flies trapped. Baits are placed in the two receptacles and flies attracted by the bait enter through the space between the two boards and feed on it and later, fly up through the slits and are practically imprisoned inside the wire gauze receptacles. Jak fruit, sugarcane, meat, fish, etc., were tried as baits and of these fish, slightly putrified gave the highest catches. In one day as many as 6081 flies were caught in one of these traps. The cost of the trap is Rs. 5 and the cost of meat or fish used as bait will be about 4 to 6 annas per month.

The fly maggot trap as the name implies is for trapping maggots. It consists of a wooden frame work enclosed by wire netting all round and is open above for dumping in manure. This is provided with a zinc drain filled with water. The maggots which breed in the manure heap in the course of their wanderings fall into the drain and are drowned. The trap is to be gradually filled with manure until it is full. Assistant Entomologist, T. V. Subramanya Ayyar has been conducting certain experiments to make the dung more attractive to the flies for egglaying. Of the various substances tried by him such as citronella oil (at a strength of $\frac{1}{4}$ oz. per gallon of water) and gingelly oil cake (3 ozs. per gallon of water soaked overnight) were found to be the most effective. Of the two, gingelly oil cake being easily available and cheaper, should be preferred. A galvanised iron sheet, bent along the length and hung up a little above ground level and filled with manure as in the other case has been found to serve the same purpose. In this case the maggots travel along the length and drop down at the ends and can be trapped in mud chatties below the two ends.

It has to be admitted in this connection that traps such as those mentioned above help the reduction of flies only to a limited extent. The most important thing however is to attend to the breeding places of flies. The proper disposal of night soil, village and town rubbish etc., will to a great extent solve the problem for which the co-operation of the health officers is necessary.

Conclusion. There are other ways as well in which insects affect man but I hope I have placed enough material before you to show the part played by them in rural reconstruction.

NOTES ON SOME IMPORTANT FORAGE AND PASTURE GRASSES

BY T. R. KESAVAN, D. V. M., F. F. Sc.

The value of pastures has long been recognized and studied by investigators in many parts of the world. There has recently been a renewed interest on the subject in India. Such development in nutrition as the necessity for vitamins, the importance of mineral salts and the effects of deficiencies of these food factors furnish a broader basis of study than previously existed. Pasture grasses are particularly good sources of vitamins, minerals and in many cases a high grade of protein.

Inquiry has now been extended into the nutritive value of pastures, the deficiencies that may occur in them, and means of increasing their value by the use of well-selected food supplements on the one hand, and the enrichment of the soil and pasture management on the other.

The nutritive value of many varieties of grasses and legumes, both native and exotic, have been tried in the various stock farms and breeding stations of Japan, Philippines and Java of which some of the most important forage and pasture crops that may show promise in India are the following:—

Pasture Grasses: **Kikuju grass** (*Pennisetum clandestinum*). It is a first class tropical pasture grass for dairy animals that they like and will eat readily. All kinds of poultry also like this when it is young and tender. This grass is light green in colour and is used extensively for lawns, parks and playgrounds in many towns of Japan, Java and Malaya. It thrives best at altitudes of 1,600 feet or more, where there is sufficient moisture throughout the year, where it will form a thick mat-like growth when planted in rich soil. The grass does not seed and must be propagated from roots or cuttings.

Rhodes Grass. (*Chloris gayana*). This grass is considered as a dual purpose grass in Japan and is extensively used there for grazing purposes and also for curing into hay. It should not be grazed during the first year after planting as it roots very shallowly during this time and the cattle may pull it up by the roots. But after the first year the root system is sufficiently developed and it will stand grazing.

Bermuda Grass. (*Cynodon dactylon*). In Philippines this grass stands the dry season better than any other kind of grazing grass. It was imported there from Australia and is found throughout the lowlands in that country. It is very useful for lawns and poultry runs.

Dallis Grass. (*Paspalum dialatatum*). This grass is extensively used as a pasture grass for dairy cattle in Queensland. It grows well

in moist soils and produces dense masses of palatable stems and leaves of dark green colour. Where weeds are eliminated it grows very well and reseeds itself. It may be considered as a valuable pasture grass in localities where the rainfall is more or less frequent throughout the year.

Carpet Grass. (*Paspalum compressum*). This grass is well liked by all kinds of herbivorous animals as well as poultry. The growth is short and eventually forms a mat-like covering of the ground which gives the sensation, when walking on it, of a thick carpet. It is a very promising pasture grass in localities where there is sufficient moisture throughout the year.

Buffaloe Grass. (*Paspalum cojugatum*). It is a common tropical pasture grass. Cattle, buffaloes and sheep eat it readily but horses are not fond of it. It will grow abundantly and often forms pure growths in shady places, especially in low ground.

Para Grass. (*Panicum Barbinode* Trin) It is also a tropical grass and is liked by cattle and buffaloes and, when tender, by horses and other stock. It is a very nutritious one but coarse and growing horizontally, producing roots readily and growing best in moist soils.

Natal Grass (*Tricholaena rosea*) It is a variety of Red top ox-herd's grass, of which there are a number of varieties belonging to the same family. It was imported into the Philippines from Australia planted in various stock farms in that country and it is considered as a dual purpose grass there. All classes of herbivorus animals eat it readily. It is also used for making a low grade hay and fed to cattle mixed with other kind of hay in the Phillippines.

Molasses Grass ; Varagua, Gordura and Braziliam Stink grass. (*Melinis minutiflora*) This grass is a native of Brazil, where it is propagated in large areas for fattening beef cattle for the market. It was imported into Japan and seen growing well in some stock farms at Tokyo. Cattle are very fond of this grass when it is young, but after it flowers which is usually in November, in Japan stock will not eat it readily, particularly so if the animals are not accustomed to eating it when it is young. The grass emits an odour, especially before it flowers, which resembles somewhat the odour of molasses.

Bungalon. (*Homalocenchus hexandra*) It is seen growing around Manila city. Cattle, sheep and goats readily eat it.

Barit. (*Leersia hexandra*) This is cultivated abundantly in many towns in Java and Philippines and sold in small bundles to 'Tonga Wallas' there as a cut feed for horses. It is reproduced by cuttings. It roots readily at the nodes if there is plenty of moisture in the soil. Cattle are fond of this grass and will readily eat it.

Silage Crops. Milo maize (*Holcus sp.*). All classes of farm animals, including swine and poultry, will eat the seeds readily and they are considered to have 50% of the feeding value of corn. Generally it is raised as a silage crop. It thrives under the same condition as for corn and is cut and fed when the grain is in the dough stage. It is best fed when put through a feed cutter, stalks, grain and all.

Sudan grass (*Holcus sudanensis*). Sudan grass is a member of the grain sorghum family, as is milo maize. It is best not to plant both of them on the same farm or, if this is done, they should be planted far about in order to prevent them from hybridizing ; as the hybrid plant, particularly the seeds, are somewhat dangerous to stock that eat them. This grass may be fed as a silage or, if conditions are favourable, cut when the seeds are in the dough stage and sun-dried into hay. It is a valuable dairy-animal feed and it may also be fed to horses either as a silage or as hay. It is a heavy yielder and may be cut three or four times during one cropping season.

Japanese Cane ; Uba Cane (*Saccharum Japonicum*). It is cultivated in many stock farms in Japan as a succulent hog feed during the dry season ; the leaves and tops fed to cattle, sheep and goats and the stalks cut into short pieces and fed to hogs. They will chew them for the juice and spit-out the fibrous portion. Hogs are very fond of the juice and it is believed to be the best green feed that can be raised for them, without irrigation, as a dry-season feed.

Napier Grass. (*Pennisetum purpureum*). This grass resembles Uba Cane in appearance and is a heavy yielder and may be cut repeatedly without being transplanted for a number of years. It is believed that it is more palatable and a better feed for horses than guinea grass, and they will do fairly well on it if they are fed with supplements of suitable concentrates with it.

Guinea Grass. (*Panicum maximum*). Guinea grass requires more care than Napier grass and should be transplanted, from the roots, at least every three or four years to prevent the bunches from becoming root-bound. All animals are very fond of the grass and also can be fed as a silage feed for riding ponies.

Japanese Millet. (*Panicum frumentaceum*). It is the best dairy cow's feed in Japan. The animals are very fond of it and would eat it in preference to any other kind of green feed offered to them. It is believed that it increases the milk production of dairy cows and goats when fed with it. It may be fed as a silage and if properly cured makes also a very good hay for dairy animals.

Teosinte. (*Euchlaena Mexicana*). Teosinte has about the same feeding value as has a good quality of green corn fodder for dairy cows. It is extensively cultivated in many stock farms in Japan and Philippines and fed as a silage for cattle there.

Legumes: Cowpea. (*Vigna unguiculata*). Cowpea is a very good feed for dairy cattle, fed as silage or as a hay mixed with some other kinds of hay in order to prevent cattle bowel disturbances. Poultry are very fond of the peas, as well as milo maize and adlay seeds. These three make a very good combination and variety of poultry feed when planted in their runs or yards.

Soy Beans (*Glycine hispida*). Soy beans are planted and used as a silage for riding ponies and dairy cattle in many stock farms. It is very rich in vegetable protein and also can be used as a hay.

Velvet beans (*Stizolobium deeringianum*). The dried beans have about the same nutritional value as wheat bran and the beans may be ground and mixed with other concentrates and fed to swine and cattle. They can be planted in rice stubbles immediately after the plants have headed and can be grazed by cattle when they are in the flowering stage. After the rice is headed and the long stubble retained they will serve as support for the climbing plants to keep them off the ground. In this way, they serve a dual purpose; as a good feed for the animal and as a fertilizer.

Tapilan Beans. (*Phaseolus calcaratus*). They have been also planted in many stock farms and used for the same purposes as for soy beans. Dried leaves of Tapilan beans may be ground fine and used also as a poultry feed.

Dry Roughage: Rice Hay :— It is believed to be reasonably satisfactory as a feed for horses and cattle when cut at the proper stage and cured without being wet.

The most important problem is its storage, should be prevented from getting wet, otherwise its mineral content may be lost. It is advisable to bale it when dry so it would occupy less space. When feeding, if possible chop hay into pieces, 2 or 3 inches long to decrease wastage.

Corn Fodder and Corn Stover. Like rice straw, corn fodder and corn stover are merely a maintenance roughage and should be cut in the proper stage and stocked until the ears harden. These should then be husked and the fodder put through a corn chopper, and the cut pieces (stover) may be fed to cattle. The chief difficulty in feeding corn fodder is similar to that in curing hay, i. e., moulding when it is a little on the green side, or when it gets wet.

Conclusion. Forage production is regarded as a very important phase of Agriculture in any country, and the need for better forage and pasture grasses for different classes of animals has been an important problem in the development of the livestock industry, and in tropical countries it may be considered doubly so and a real problem. Certainly if we could grow more nutritious feed we could raise much better livestock.

SELECTED ARTICLE

SCIENCE AND THE CONSERVATION OF FOOD

Agencies Affecting Foods. There are many agencies, biological, chemical and physical, which may affect foodstuffs, either by spoiling their appearance or rendering them unfit for consumption. Bacteria are most important among the biological factors, but yeasts and moulds, which may either aid or hinder preservation, have also to be considered; and then there are such animal pests as sugar and cheese mites, moths, rats and beetles, all of which may damage the raw material used in food manufacture, or attack the finished products.

Food products have also to be protected from heat, dampness, the oxygen of the air and sometimes from light as well. These last two factors, acting in association, produce the bleaching or discoloration which is sometimes seen in bottled fruit, when pieces of the fruit project beyond the syrup into the space at the top of the bottle. Then again, canned food must be protected from the action of acids and salts which might corrode the tin.

There are also substances contained in the food-stuffs themselves which may have a destructive action, namely, the enzymes. These are present in both vegetable and animal cells but they can exist independently of them. One enzyme having an important bearing on food preservation in connexion with jam-making is pectase, which, if it is allowed to do so, will destroy the pectin which is responsible for the "setting" property of jam. Jam, in fact, presents a number of problems to the manufacturer, and the way he has been helped to solve these is a good example of the assistance which science has rendered to industry.

Jams. Substances of importance for the keeping quality of jam are held in solution in the water it contains, for example, sugar, acids and salts. The osmotic pressure of these substances, the sugar in particular, can be responsible for protecting the jam from the growth of moulds, because, for germination, a mould spore must first absorb water. If the osmotic pressure of the jam is equal to or greater than that of any spore which falls upon it, either no water will pass from the jam to the spore or the spore will lose water and so dry up and eventually die, and in both these cases its further development will be arrested. The British Food Manufacturers' Research Association has actually determined the minimum percentage of solids necessary to bring about this condition.

There is, however, still a risk of moulds developing in a jam if the relative humidity of the atmosphere to which it is exposed is above 82 per cent. Then the jam will absorb moisture and so its osmotic pressure becomes lower than that of the mould spores.

Another defect frequently arising in jams is crystallization or granulation of the sugar. In the jam-making process, sucrose is inverted by the boiling acid, and it is necessary that just the right degree of inversion should take place if no crystallization is to occur. Thus if the sugar is under-inverted too much sucrose is left and this crystallizes out. If, on the other hand, it is over-inverted, too much dextrose is formed and this crystallizes out. As fruits vary very much in the amount of acid they contain, the manufacturer must be able to discover the degree of inversion taking place, and modify his process accordingly.

The setting property of jam has already been mentioned, and it is important to remember that unless jam is properly set it cannot be transported and handled. It is therefore necessary to make use of the pectin naturally occurring in fruit cells. Pectin is a complex of different substances and therefore its properties vary from one fruit to another; for this reason the setting properties of some

fruit juices are superior to those of others, for example, goose-berry is poor. Now, pectin must be protected from the naturally occurring enzyme, pectase, which destroys it. So long as the cell structure remains intact, the pectase does not attack the pectin, but in fruit which has become damaged by bruising, the pectase appears to get out of control. and in the case of raspberries all the pectin may disappear in twelve hours. In this fact lies the justification for manufacturers using "added fruit juice" or "pectin" in the making of jam.

Pectin may also lose its jellifying powers by the action of prolonged heat. It is therefore necessary to eliminate any over-heating in the manufacturing process, and this is not always easy when large quantities of liquid have to be dealt with.

Meat Products. The processes of jam-making are more familiar to the public than those of meat preservation. An important difference to bear in mind is that meat has no natural acid to assist the preservation process. Meat, if it is to be kept must be protected from putrefactive bacteria, which though harmless in themselves feed upon animal and vegetable debris, gradually converting them into ammonia and carbon dioxide etc.

Refrigeration deprives the bacteria of water which is necessary for their growth, the water in the meat tissues being converted into ice. The bacteria are not necessarily killed, but their development is inhibited. Some of the bacteria can grow at temperatures around freezing point, and for this reason chilled meat cannot be kept so long as meat which is frozen at temperatures well below freezing point. The growth of bacteria can also be restrained by certain concentrations of carbon dioxide in the air.

Although the spores of some bacteria are highly resistant to heat it has been possible to use heat sterilization as a method for meat preservation. It is of course necessary for the manufacturer to know the combinations of time and temperature at which all spores likely to be present will be destroyed. Allowance must be made, when the product is packed in a tin, for the penetration of heat to the deepest part of the package; and the rate of penetration will vary considerably with the density of the contents, being much slower for meat than for a tin of fluid.

Food Poisoning. A product canned by correct processes is one of the safest articles of diet it is possible to have, and many complaints made to manufacturers that their products have caused illness, have shown on investigation to have no justification. According to Prof. Tanner of Illinois (speaking at the Congress of Microbiology, 1936), in the past canners and distributors have tried to avoid publicity by settling their claimes out of court. Medical practitioners are often unfamiliar with the procedures necessary to establish definitely the causative factors in food poisoning. There is also much prejudice on the part of the public as well as ignorance of the great care generally taken in the manufacture of these products. It has been shown in Great Britain and the United States that by far the largest number of cases of food poisoning are caused by foods which have been prepared in the home or by products sold in a pre-cooked condition but not sterilized.

Tinplate Containers. A difficulty, still not completely solved, is that of producing in commercial quantities the perfect tinplate for the construction of a can, or tin stopper for a glass jar. Then also, the machinery necessary in making the can may break the tin coating and expose the base metal, iron. The iron thus exposed may be attacked by the salt present in meat and vegetable products. An attempt has been made to produce a lacquer which when applied to the tinplate would prevent this action. Several difficulties have so far prevented the realization of this ideal.

Preservation of Meat. The preservation of meat by means of salts has long been practised, but only recently have its scientific principles been studied. The production of colour as well as preservation from putrefaction is brought about by the use of saltpetre. Bacterial action converts the nitrate of the saltpetre into nitrite, which combines with haemoglobin, and when the meat is boiled the latter is converted into nitrohaemochromogen, which has the bright red colour characteristic of properly cured silverside. The micrococci responsible for this action can grow in media containing as much as 20 per cent. of salt, in which concentrations the putrefactive bacteria cannot exist. Nor can their spores develop in media containing as much as 10 per cent. of salt.

Chocolate and Confectionery. Changes in atmospheric temperature and humidity are liable to produce changes in chocolate and confectionery. The British Food Manufacturers' Research Association has given manufacturers a great deal of help in determining the conditions necessary for the production and storage of satisfactory chocolate. In the factory, it is generally possible to secure these conditions, but in retail premises it is not so easy. If the manufacturer were able to deliver his goods direct from his warehouse to consumer, defective products would not be so commonly seen as they are at the present time.

(*Nature*, July 31, 1937.)

Research Notes.

The Moringa Hairy Caterpillar.

Eupterote mollifera, Wlk., commonly known as the moringa hairy caterpillar is a pest of *Moringa pterygosperma* in South India. Though Lefroy, Fletcher and Ramakrishna Ayyar have made mention of this insect in their publications, no detailed account of it has been given by any of them. Hence the studies on the pest.

The moths are about 50 to 60 mm. and yellow in color. Pale yellow eggs are laid in clusters on the stalks of the moringa leaves and measure 1 mm. in diameter. The egg period varies from 14—18 days. The newly hatched caterpillars are 2 mm. long and 0 5 mm. broad with reddish head and yellowish pink body on which are seen numerous warts with black and brown hairs. The caterpillars are gregarious in habit and feed at night on the leaves of the food plant and rest during day time on the tree trunks. They undergo five moults. The mature caterpillars are 30—40 mm. long and 4 to 5 mm. broad. When the caterpillars are full grown they leave the food plant, enter the soil and pupate in cocoons made of silk covered with hairs on the body and particles of soil. The larval period is about 41 to 46 days. The pupae which are brown in color are 15—20 mm. long and 7 mm. broad. In about 27--30 days adult moths emerge from the pupae. The total life cycle of the pest ranges from 82 to 94 days.

The pest is known to do serious damage to moringa in some cases by defoliating the trees. In addition to moringa it has been noted recently on portia (*Thespesia populnea*) planted as avenue trees in Korukkai (Tanjore Dt.). It has also been recorded from Ceylon on *Erythrina*. An egg parasite has been collected at Coimbatore but is not found in sufficient numbers to check the pest. As the caterpillars have got the habit of resting on tree trunks in groups in large numbers they can be destroyed by burning them with a lighted torch or by spraying *Lotal* at a strength of 5 ozs. in 1 gallon of water. Care should be taken to see that the caterpillars are not handled as they have irritating and poisonous hairs. The pupae may also be destroyed by raking the soil round about the food plants as the caterpillars go to the soil for pupation. Detailed studies regarding other remedies are in progress.

Agricultural Research Institute, }
Coimbatore. 15th October '37. }

M. C. Cherian.
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ABSTRACTS

The Effect of Processing on Vitamins in Fruits and Vegetables--A Review, C. R. Fellers. (*Massachusetts Agricultural Experiment Station, Bul. No. 338,* December 1936). The effects of storage, freezing, drying, and thermal treatments on the several vitamins are discussed at the end of the respective chapters. A bibliography of 235 references to the literature is appended.

Generally speaking, ordinary storage and to a lesser extent cold storage in air have no serious effect on vitamins D, E and G; have a slight to moderate destructive action on vitamins A and B; and cause serious loss of vitamin C, particularly when storage is long continued. Losses are reduced when storage is near the freezing point. Shipped-in vegetables may lose substantial quantities of vitamin C during shipment and incidental marketing operations. This is not true in the case of most fruits and such acid vegetables as tomatoes and rhubarb. Properly packaged frozen fruits and vegetables show practically no losses in any of the vitamins even after long storage at 0°F or below.

Destruction of vitamin C is very rapid when frozen fruits and vegetables are defrosted in air. Little loss in vitamin C occurs if solidly frozen vegetables are cooked in boiling water without previous defrosting. Sun-drying is more destructive to vitamins A and C than artificial dehydration. Fermentation of fruits and vegetables is injurious to vitamin C.

In general, heat treatments such as cooking and canning are not injurious to any of the vitamins, but the accompanying oxidations and other destructive reactions, unless carefully controlled, are decidedly injurious to vitamins B and C. Fruits or vegetables containing added acid may be heated with less destructions to vitamins B, C and G than non-acid foods. Thus, canned fruits retain vitamin C very well, while canned vegetables lose much of their original C. Modern methods of vacuumization and air removal and sealed packaging now used in the food preservation industries are practical aids in preventing vitamin losses through oxidation. It is not believed that cooking and canning are harmful to the vitamins A, G, D and E of fruits, vegetables and cereals.

Heat in the presence of alkalies is very destructive to all the vitamins. Rapid cooking, with minimum exposure to air, serves to minimize losses of vitamins C, A, and B.

Food manufacturing operations such as blanching, openkettle cooking, pulping, and filling containers are ordinarily destructive to vitamins C and probably to a lesser degree to B and A as well.

There is no satisfactory evidence that foods once canned lose appreciable quantities of any vitamins on storage. Losses of vitamins C and A in reheating canned foods for table use are small. Large quantities of the water-soluble vitamins B, C, and G are dissolved in the cooking water of fruits and vegetables and are lost unless this cooking water is utilized. In conclusion, it should be borne in mind that this field of research is in an active state of change. The literature is being multiplied very rapidly. There is still need for much more research before all the effects of environmental factors on vitamin stability can be stated with finality.

Studies of the Physiology of Coffea arabica. I. Photosynthesis of Coffee leaves under natural conditions. Nutman F. J. *Ann. Bot.* (N. S.) 1 : (3) 353—367 (1937).

The disease of *Coffea arabica* known as 'overbearing and die-back' prevalent in the coffee growing areas of E. Africa is explained as due to the heavy demands for carbohydrate by the developing crop which exceed the total daily photosynthetic activity. The branches then die-back, roots degenerate and the tree is

injured and remains unproductive. Since shortage of carbohydrate is associated with this disease, the author has presented the results of his investigations into the rate of carbon assimilation under field conditions by leaves of *Coffea arabica* growing in the Northern Province of Tanganyika Territory.

The apparent rate of assimilation for whole trees as well as the diurnal march of assimilatory rate for single attached leaf are determined under different degrees of sun and shade and full data are presented which show that the rate varies directly when the intensity of light is low but is inversely proportional in high light intensity. The total daily assimilation is greater under a moderately shaded condition than in full sunshine, and that during cloudy weather, the assimilation rate remains at a fairly constant though low value, while in the sun the rates show a large depression during the midday hours. These studies show why the coffee plant assimilates better under shade and why the plant can stand heavy bearing better under shady conditions than under exposure to intense sun-light.

V. T. B.

The control of the leaf spot disease in young Coconuts. Tammes, P. M. L. *Landbouw*, 13 : 69—73 (1937). The writer's observations in Java indicate that freedom from grey spot or leaf blight of coconuts (*Pestalozzia palmarum*) : R. A. M., xv, p. 15) may be ensured by the provision of light shade, e. g., *Sesqania grandiflora* cuttings, during the first two years after planting. Such conditions frequently obtain in native plantings, where the seed nuts are kept under shade in the gardens or planted out in maize fields. In a test in 1936 the incidence of infection in shaded plots was only 2 per cent. compared with 46 per cent. in exposed sites. Excessive shade, however, should be avoided as tending to weaken the development of the plants. (*Rev. Appl. Mycol.* 16 : 529).

Gleanings.

Controlling Growth of Weeds. Sulphuric acid spray as a method of controlling the growth of weeds in fields of grain is gaining ground in the United States. Tests covering several years and several thousand acres of grain fields in California have demonstrated the effectiveness of this method. During the present season more than 6000 acres are being kept free from weeds by spraying with solutions of sulphuric acid which kill weeds but do not injure the growing grain. This is a meagre beginning when in California alone there are more than half a million acres that could be benefited and when the vast grain fields of the midwest and the Pacific Northwest have not yet been touched. In France the treatment is already applied to more than 500,000 acres and its use is growing in England and on the Continent. The California development includes testing new, more efficient types of sprayers to cover larger areas more effectively. (*Scientific American*, September 1937).

Treat ulcers by continuous drip of milk into stomach. A continuous feeding of milk, drop by drop, into the patient's stomach is the new method of treating stomach ulcers reported by Dr. Asher Winkelstein of New York.

Frequent feeding of small amounts of milk and cream has for years been part of the standard medical treatment of stomach ulcer. The milk, together with alternating doses of alkaline powders such as bicarbonate of soda, is given to neutralize the acid normally secreted by the stomach but which irritates the ulcer and prevents its healing.

Dr. Winkelstein's modification of this method into a constant feeding of milk, a drop at a time through a tube, is based on studies of stomach secretion, especially at night.

The importance in connection with stomach ulcers of nervous over-secretion of acid by the stomach was emphasised by Dr. Winkelstein.—Science Service. (*Scientific American*, September 1937).

Oil and Cake Products from Coffee. It is stated that German chemists have been co-operating with the Brazilian authorities in order to discover uses for the surplus Brazil coffee crop and that the President of the National Coffee Department has received a report from the Brazilian technical representative in Germany reporting the success of an experiment for the extraction of subproducts from coffee. It is claimed that 13% of high quality oil has been extracted from coffee beans, compared with 20% extracted from soya beans, while the residue provides first class cattle cake. It is hoped that the discovery will in future prevent the unnecessary destruction of surplus coffee. (*Chemistry and Industry*, September 18, 1937.)

Review.

The Punjab Fruit Journal. Feroz Printing Works, Lahore.

The *Punjab Fruit Journal* is a quarterly journal and an organ of the Punjab Provincial Co-operative Fruit Development Board. It is perhaps the first of its kind in India, and the most important feature of the Journal is its bilingual character. The articles are published in English and in Urdu. The journal meets the keen demand that exists for popular literature on cultivation of fruit plants, and preservation of fruits. It aims at building up the fruit industry of the Punjab on scientific and economic basis and it has rendered much help in uniting the fruit growers, and keeping them informed of the beneficial activities of the Punjab Fruit Development Board.

In the third issue of this journal there are four interesting articles in English, namely, "Is there real danger of over-production of fruit in Punjab", "Some salient points about nitrogen carrying fertilizers". "Physiology and nutrition of pruning", and "Tomato juice—its preparation and preservation" and the notable items in the Urudu section are "Propagation of stone fruits", "Manuring of oranges", "List of fruit commission agents of U. P." and "Seasonal hints".

The annual subscription is low, being Rs. two only; it can be had from the Secretary, Punjab Provincial Co-operative Fruit Development Eoard, Lyallpur.

(J. S. P.)

Crop & Trade Reports.

Paddy—1937-38—First Forecast Report. The average of the areas under paddy in the Madras Presidency during the five years ending 1935-36 has represented 15·3 per cent. of the total area under paddy in India.

The area sown with paddy up to the 25th September 1937 is estimated at 5,893,000 acres. When compared with the area of 6,010,000 acres estimated for the corresponding period of last year, it reveals a decrease of 1·9 per cent.

The estimated area is the same as last year in Coimbatore and Tinnevelly; it exceeds the corresponding area of last year in West Godavari, Kistna, Kurnool, Cuddapah, Nellore, South Arcot, Salem, Tanjore, Ramnad and the Nilgiris. The decrease in area in other districts is generally attributed to insufficiency of rains and of water supply in tanks.

The first crop of paddy is being harvested in parts of Tanjore and on the West Coast. The yield is expected to be about normal. The condition of the standing crop is generally fair.

The wholesale price of paddy, second sort, per imperial maund of 82⅖ lb. as reported from important markets on 4th October 1937 was Rs. 2-12-0 in Chittoor, Rs. 2—10—0 in Vellore, Madura and Tinnevelly, Rs. 2—9—0 in Virudhunagar, Rs 2—7—0 in Masulipatam and Trichinopoly, Rs. 2—6—0 in Vizianagaram, Ellore, Bezwada and Guntur, Rs. 2—5—0 in Cocanada and Rajahmundry, Rs. 1—15—0 in Negapatam and ranged from Rs. 2—2—0 to Rs. 2—4—0 in the other markets. When compared with the prices published in the last report, i. e., those which prevailed on 8th February 1937, the prices reveal a rise of 30 per cent. in Trichinopoly, 29 per cent. in Negapatam, 25 per cent. in Kumbakonam, 23 per cent. in Cocanada, 20 per cent. in Madura and Tinnevelly, 17 per cent. in Mangalore, 16 per cent. in Rajahmundry and Cuddalore, 15 per cent. in Ellore and Masulipatam, 12 per cent. in Bezwada and 9 per cent. in Guntur.

Sugarcane—1937—Second Report The average of the areas under sugarcane in the Madras Presidency during the five years ending 1935—36 has represented 3·4 per cent. of the total area under sugarcane in India.

The area planted with sugarcane up to the 25th September 1937 is estimated at 90,780 acres. When compared with the area of 109,690 acres estimated for the corresponding period of last year, it reveals a decrease of 17·2 per cent.

The decrease in area is general except in Vizagapatum, Ramnad, Tinnevelly and South Kanara. The estimated area is the same as last year in Tinnevelly; it exceeds the corresponding area of last year by 11·5 per cent. in Vizagapatam and by 3·8 per cent. in South Kanara. The decrease in area elsewhere is generally attributed to the low price of jaggery which prevailed at the time of planting of cane.

The condition of the crop is generally satisfactory except in Chittoor and North Arcot where the crop has been affected by drought to some extent. If a normal season is experienced during the rest of the growing period, the yield is estimated at 259,120 tons of jaggery as against 308,820 tons for the corresponding period of last year.

The wholesale price of jaggery per imperial maund of 82⅖ lb. as reported from important markets on the 4th October 1937 was Rs. 5-8-0 in Adoni, Rs. 4-12-0 in Mangalore, Rs. 4—11—0 in Trichinopoly, Rs. 4—10—0 in Erode, Rs. 4—2—0 in Salem and Coimbatore, Rs. 3—15—0 in Rajahmundry and Cuddalore, Rs. 3—5—0 in Cocanada and Vellore, Rs. 3—10—0 in Chittoor, Rs. 2-14—0 in Vizagapatam. Rs. 2—12—0 in Vizianagaram, Rs. 2—7—0 in Bellary. When compared with the prices published in the last report, i. e., those which prevailed on 6th September 1937, the prices reveal a rise of 14 per cent. in Trichinopoly, 9 per cent. in Vizagapatam, 3 per cent. in Rajahmundry and 2 per cent. in Cuddalore and a fall of 5 per cent in Cocanada, the prices remaining stationary in the other centres.

Groundnut—1937—Third forecast report. The average of the areas under groundnut in the Madras Presidency during the five years ending 1935-36 has represented 47·7 per cent. of the total area under groundnut in India.

The area sown with groundnut up to the 25th September 1937 is estimated at 3,656,400 acres. When compared with the area of 2,853,100 acres estimated for the corresponding period of the previous year, it reveals an increase of 28·2 per cent.

The estimated area is the same as last year in Nellore, and falls short of the corresponding area of last year only in Trichinopoly. The increase in area which is noticeable elsewhere is attributed to the incentive of favourable prices at the time of sowing.

The summer crop throughout has been harvested. The yields were generally normal. The yield of the early crop in Salem and Coimbatore is reported to be generally normal.

The condition of the main crop is reported to be below normal outside Kistna, Guntur, Salem, Trichinopoly, the South and Malabar due mainly to drought. In parts of South Arcot, the crop has also been affected by an attack of hairy caterpillar.

The wholesale price of groundnut (shelled) per imperial maund of 82$\frac{2}{7}$ lb. as reported from important markets on 4th October 1937 was Rs. 5—8—0 in Cuddalore, Rs. 5—5—0 in Vizagapatam, Rs. 5—4—0 in Vizianagaram, Rs. 4—10—0 in Erode, Rs 4—8—0 in Cuddapah, Rs. 4—6—0 in Nandyal, Rs 4—3—0 in Bellary and Vellore, and Rs. 4—0—0 in Adoni. When compared with the prices published in the last report, i. e., those which prevailed on 2nd August 1937, these prices reveal a fall of 18 per cent. in Vellore. 17 per cent. in Adoni, 13 per cent. in Vizagapatam, 12 per cent. in Bellary, 11 per cent. in Vizianagaram, 10 per cent. in Erode, 9 per cent. in Cuddapah, and 8 per cent. in Cuddalore.

Gingelly—1937-38—Second Report.

The average of the areas under gingelly in the Madras Presidency during the five years ending 1935—36 has represented 15·2 per cent. of the total area under gingelly in India.

The area sown with gingelly up to the 25th September 1937 is estimated at 468,000 acres. When compared with the area of 437,200 acres estimated for the corresponding period of last year, it reveals an increase of 7 per cent.

The estimated area is the same as last year in Malabar; it exceeds the corresponding area of last year in Vizagapatam, Nellore, the Central districts (Trichinopoly excepted), the South (Tinnevelly excepted) and South Kanara and falls short of it elsewhere. The variations are marked in West Godavari (– 17,000 acres), North Arcot (+ 14,000 acres), Salem (+ 26,500 acres) and Coimbatore (+ 27,500 acres).

The early crop of gingelly has been harvested in parts. The yield was generally normal except in Vizagapatam. The condition of the standing crop is fairly satisfactory except in Bellary, Anantapur, Cuddapah, South Arcot, Chittoor, North Arcot and Madura where it has been affected by drought to some extent. The crop has also been affected by an attack of hairy caterpillar in South Arcot and by insect pests and fungus diseases in Madura.

The wholesale price of Gingelly per imperial maund of 82$\frac{2}{7}$ lb. as reported from important markets on 4th October 1937 was Rs. 6—15—0 in Trichinopoly, Rs. 6—8—0 in Cocanada, Rs. 6—7—0 in Ellore and Cuddalore, Rs. 6—6—0 in Tinnevelly, Rs. 6—3—0 in Tuticorin, Rs 5—14—0 in Rajahmundry, Rs. 5—12—0 in Salem Rs. 5—10—0 in Vizianagaram and Rs. 5—7—0 in Vizagapatam When compared with the prices published in the last report, i. e. those which prevailed on 9th August 1937, these prices reveal a rise of eleven per cent. in Trichinopoly, eight per cent. in Cocanada, four per cent. in Vizagapatam, two per cent. in Tinnevelly and a fall of four per cent. in Cuddalore and one per cent. in Vizianagaram, the prices remaining stationary in the other centres.

Ginger—1937—First Forecast Report. The area under ginger up to the 25th August 1937 in the Malabar district, is estimated at 11,000 acres as against 10,000 acres for the corresponding period of the previous year. The condition of the crop is satisfactory.

Pepper—1937—First Report. The area under pepper up to 25th August 1937 in the districts of Malabar and South Kanara is estimated at 104,150 acres (95,500 acres in Malabar and 8,650 acres in South Kanara) as against 102,600 acres (94,000 acres in Malabar and 8,600 acres in South Kanara) estimated for the corresponding period of last year. The condition of the crop is satisfactory in South Kanara. In Malabar, early rains brought about flushing before the normal season and subsequent rains having caused a second flushing, a yield below the normal is expected.

The wholesale price of pepper per imperial maund of 82$\frac{2}{7}$ lb. as reported from important markets on 6th September 1937 was Rs. 13—5—0 in Calicut, Rs. 13—11—0 in Tellicherry and Rs. 13—12—0 in Mangalore. When compared with the prices in the beginning of January 1937, these prices show a fall of about 20 per cent. in Calicut, of about 22 per cent. in Tellicherry and of about 24 per cent. in Mangalore.

Cotton—1937-38—Second Report. The average of the areas under cotton in the Madras Presidency during the five years ending 1935—36 has represented 9·5 per cent. of the total area under cotton in India.

The area under cotton up to the 25th September 1937 is estimated at 656,700 acres. When compared with the area of 756,700 acres estimated for the corresponding period of last year, it reveals a decrease of 13·2 per cent. The decrease in area is marked in Kurnool and Bellary where the area fell from 392,000 acres to 295,000 acres, i.e. by 24·7 per cent. owing mainly to want of timely and sufficient rains.

The area in the central districts and the south relates partly to the last year's crop and partly to the current year's sowings which have commenced in parts.

The condition of the standing crop is generally satisfactory, except in Bellary where the early cotton crop suffered from drought and from an attack by the red hairy caterpillar.

The wholesale price of cotton lint per imperial maund of 82$\frac{2}{7}$ lb. as reported from important markets on 4th October 1937 was about Rs. 18-15-0 for Cocanadas, Rs. 18—11—0 for white Northerns. Rs. 18—8—0 for red Northerns, Rs. 16—12—0 for Westerns (*mungari* crop), Rs. 18—14—0 for Westerns (*Jawari* crop), Rs. 25-4-0 for Cambodia, Rs. 26—15—0 for Coimbatore-*Karunganni*, Rs 21—8—0 for Tinnevelly-*Karunganni*, Rs. 19—7—0 for Tinnevellies and Rs. 21—8—0 for *Nadam* cotton. When compared with the prices published in the last report, i.e. those which prevailed on 6th September 1937, the prices reveal a fall of six per cent. in the case of Westerns (*mungari* crop) and Tinnevellies, five per cent. in the case of Westerns (*Jawari* crop), four per cent. in the case of Cambodia, Tinnevelly-*Karunganni* and *Nadam* and two per cent in the case of Coimbatore-*Karunganni*, the price of Cocanadas remaining stationary. (*Director of Industries, Madras*).

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1937 to 15th October 1937 amounted to 475,668 bales of 409 lb. lint as against an estimate of 533,100 bales of the total crop of 1936—37. The receipts in the corresponding period of the previous year were 558,873 bales. 365,588 bales mainly of pressed cotton were received at spinning mills and 197,791 bales were exported by sea while 93,814 bales were imported by sea mainly from Karachi and Bombay. (*Director of Agriculture, Madras*).

College News and Notes.

H. E. the Governor's visit. His Excellency the Governor of Madras and Lady Erskine accompanied by their personal staff arrived at the Agricultural College Estate on the 10th afternoon. His Excellency and party stayed on the College premises throughout their stay of four days at Coimbatore. The Principal's bungalow which was suitably furnished for the purpose was placed at the disposal of H. E. and party by Mr. Broadfoot, Principal of the College. H. E. had a crowded programme in Coimbatore, and wherever he went he was accorded a very warm reception. On the 10th evening, H. E. visited the Government of

India Sugarcane Breeding Station, where he was taken round by Rao Bahadur T. S. Venkatraman, C.I.E , the Government Sugarcane Expert and Mr. N. L. Dutt, the Second Sugarcane Expert. On the 12th afternoon H. E. accompanied by Mr. P. H. Rama Reddi, Director of Agriculture, visited the various sections of the Agricultural Research Institute, where the activities of the Department were explained to him by the heads of research sections. Later in the day H. E. was shown round the Freeman Building, the students' play fields, the College Dairy and the Central Farm. His Excellency's interest in the welfare of the rural population and in the improvement of agricultural conditions was evident from the intelligent interest he showed in the various aspects of the work of the Department.

Director of Agriculture, Madras. The new Director of Agriculture, Mr. P. H. Rama Reddi, who took charge on the 15th September, took an early opportunity of visiting the College and Research Institute towards the end of the month. He arrived here on the 23rd and remained for six days and visited the various sections and stations. The Director again paid a visit to the College in connection with the visit of Their Excellencies.

Students' Corner : Students' tour. The students of III year B. Sc. class accompanied by Mr. M. U. Vellodi, Lecturer in Agriculture and Mr. K. Ramaswami Iyer, Assistant Lecturer, went on tour to Hosur, Krishnagiri, Gudiyattam, Cuddalore, Salem, Mettur and Erode, etc , and returned to Coimbatore on the 21st October.

Games—Cricket. In the Y. M. C. A. Cricket Tournament conducted under the auspices of the Coimbatore Athletic Association, the College team had an unbeaten record and annexed the Rhondy shield. The last match of the tournament was played against the Scout Recreation Club and the College won the match by 5 wickets and 75 runs. The Scouts who batted first were dismissed for 64 runs. For the College, Kodandaraman captured 5 wickets for 35 runs. The College replied with 139 runs for 5 wickets of which Shiva Rao made 55 and Dinker Rao 27. Our star-batsmen, C. Ramaswami and C. N. Baboo enjoyed a well earned rest and did not bat.

Other Matches. The Annamalai University Cricket team played the Agricultural College on the 9th instant. The visitors batting first put on a modest total of 110 runs. Panikkar (25), Venkatraman and Sreenivasan (18 each), and Sambandam and Balasubramaniam (13 each) were the chief contributors to this total. Dinker Rao claimed 3 wickets for 30 runs and Varadarajan 2 for 14 runs. The College replied with 127 for two wickets, C. Ramaswami (79) and Rajaram (30) not out) were the chief scorers. The brilliant single-handed running catch made on the boundary line by Venkatesan to dismiss Ramaswami will long be remembered in the annals of Coimbatore cricket.

The holiday on the 14th instant was utilized by some local lovers of cricket to assemble the best talent in Coimbatore to play a match against the Agricultural College. Though handicapped by the absence of our star-bowlers, who happened to be on a tour with the III year class, the College team acquitted themselves splendidly against an array of brilliant all-rounders collected from the Coimbatore Cricket Club, Coimbatore College, Forest College, etc. Winning the toss, the visitors put in the College to bat. Though faced with early disaster, the partership between C. Ramaswami and C. N. Baboo completely changed the aspect of the game. Baboo's masterly innings of 71 and C. Ramaswami's brilliant knock of 59, which included a glorious six off Venkatachalam which landed in front of the M. A. S. U. building were the chief features of the College battings. Other useful contributions were Varadarajan's 19, Shiva Rao's 17, Nagaraja

Rao's 15 (not out) and Shetty's 14 (not out). The College declared at 230 for the loss of 5 wickets. The visitors were dismissed for a paltry 56 runs, the only player who offered some resistance being Venkatachalam who scored 39. C. Ramaswami who bowled unchanged captured 6 wickets conceding only 26 runs. K. M. Thomas claimed 3 wickets for 19 runs.

Hockey. Taking advantage of the visit of the Annamalai University Cricket team, a match was played between the University team and the Agricultural College. Both sides were not fully represented, but the game turned out to be fast and interesting, ending in a draw of 3 all.

The Agricultural College Officers' Club. The annual Club Day which marked the culmination of a series of tournaments and other competitions in indoor and outdoor games, was celebrated on Saturday, 23rd October 1937. This was preceded by a dinner on the 22nd night which was attended by over 160 members and their friends. The beautifully decorated club drew a large crowd of spectators on the Club Day morning, when it was known that Mr. C. Ramaswami was to play in the tennis finals. The tennis finals was followed by field sports and after an interval of an hour, indoor games, elders' and children's races and table tennis finals were held.

The generous award of six more rolling cups by some of the members of the club aroused keen competition in all the Club Day sports.

The celebration came to a close on the 23rd night when the prizes and trophies of the various competitions were given away and this was followed by a variety entertainment and fire-works.

The following are the winners of the different trophies:-

Donor.	*Game.*	*Winners.*
Rao Bahadur G. N. Rangaswami Ayyangar.	Tennis Doubles.	C. Ramaswami & C. N. Baboo.
Mr. C. Ramaswami.	Tennis Singles.	M. K. Krishnaswami (C. Ramaswami not participating).
,, T. S. Ramasubrahmanyam (Padmanabha Memorial Shield).	Contract Bridge.	T. V. Reddi & R. L. N. Ayyangar.
,, N. L. Dutt.	Contract Bridge.	S. Srinivasan & T. S. Lakshmanan.
,, K. Ramiah.	Auction Bridge.	K. Krishnamurthi Rao & K. Hanumantha Rao.
,, M. C. Cherian.	Table Tennis.	K. Raghavan.
,, K. Krishnamurthi Rao.	Carrom Singles.	C. H. Krishnan.
,, H. Shiva Rao.	,, Doubles.	N. Muthuswami & C. H. Krishnan.
,, M. U. Vellodi.	Chess.	D. S. Rajabhooshanam.
Dr. K. Narayanan.	Tenekoit.	A. Mariakulandai & N. C. Tirumalachari.

Weather Review—SEPTEMBER 1937.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	5·2	-2·3	34·3
	Calingapatam	4·0	-3·4	21·5
	Vizagapatam	2·9	-3·6	19·7
	Anakapalli*	4 5	-2·9	31·2
	Samalkota*	5·5	-1·0	27·5
	Maruteru*	3·4	-3·1	23 4
	Cocanada	5·0	-0·8	29·9
	Masulipatam	3·3	-2·9	23·7
	Guntur*	5·1	+1·2	22·4
Ceded Dists.	Kurnool	4·6	-1·6	17·7
	Nandyal*	5·7	-0·4	24·8
	Hagari*	7·1	+1·9	13·3
	Bellary	3·3	-1·8	11·0
	Anantapur	7·0	-0 3	19·7
	Rentachintala	8·1	...	27·7
	Cuddapah	3·7	-2·6	14·3
	Anantharajupet*	2·7	-3·7	17·9
Carnatic	Nellore	2·2	-2·6	37·4
	Madras	4·0	-0·9	19·1
	Palur*	3·6	+0·4	13·0
	Tindivanam*	5·1	+1·4	16·8
	Cuddalore	2·4	-3·7	11·1
Central	Vellore	10·1	+2·8	24·4
	Salem	3·4	-3·2	19·7
	Hosur*	1·6	-0·9	22·4
	Coimbatore	2·2	-0·7	12·6
	Coimbatore A. C. & R. I.*	0·9	-0·2	14·5
	Trichinopoly	4·2	-0·6	25·3

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	2·5	-1·3	14·4
	Aduthurai*	2·6	...	13·5
	Madura	6·3	+1·2	13·3
	Pamban	1·0	-0·2	15·5
	Koilpatti*	1·8	-0·2	11·4
	Palamkottah	0·4	-0·9	8·5
West Coast	Trivandrum	2·1	-2·0	39·7
	Cochin	5·4	-3·6	102·4
	Calicut	4·9	-2·8	110·5
	Pattambi*	3·0	-6·3	69·3
	Taliparamba*	...	...	...
	Kasargode*	11·9	+3·1	153·6
	Nileshwar*	9·7	-0·2	140 9
	Mangalore	9·3	-1·1	132·2
Mysore and Coorg	Chitaldrug	7·7	...	15·1
	Bangalore	3·0	...	25·5
	Mysore	4·2	...	26·4
	Mercara	7·1	-3·6	107·3
Hills	Kodaikanal	10·7	+3·5	41·6
	Coonoor	1·8	...	35·9
	Ootacamund*	5·6	-1·1	40·1
	Nanjanad*	5·2	+0·3	35·9

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in Fort St. George Gazette.

Summary of weather conditions. The Bay of Bengal branch of the monsoon was active during the first two weeks of the month, in Malabar, Deccan, and along the West Coast and later withdrew.

The unsettled conditions in the Andaman Sea which appeared on 25th, formed a low pressure area in the North Bay of Bengal and later intensified into a cyclone near Sangor Island and weakened thereafter. Conditions also became unsettled in the Arabian Sea off Kathiawar Konkan coast, where a low pressure was formed on 27th and extended from off Malabar coast to off Kathiawar Coast and became less marked on 29th.

There was general rain throughout the Peninsula during the month, and in the last week thunder showers were fairly widespread in the Konkan, Mysore, and South east Madras.

Rainfall was in large defect in Circars, Ceded Districts and Central Stations

Chief falls reported were:—

Rentichintala	5·7″	Recorded on 24th.
Kurnool	2·9″1	Recorded on 24th.
Vellore	3 2″	27th.
Kodaikanal	3·0″	27th.
Nandyal	3·2″	
Hagari	3·0″	
Kasargod	3·0″	

Weather Report of the Research Institute Observatory: Report No. 9/37.

Absolute maximum in shade	93·5°F.
Absolute minimum in shade	66·0°F.
Mean maximum	89·5°F.
Departure from normal	+0 5°F.
Mean minimum in shade	70·8°F.
Departure from normal	+0·2°F.
Total rainfall for the month	0·90″
Departure from normal	- 1·54″
Heaviest fall in 24 hours	0·63″ recorded on 29th.
Total number of rainy days	2 days.
Mean daily wind velocity	2·3 M. P. H.
Mean humidity	72 0%
Departure from normal	-3·0%

Summary. Rainfall was in large defect. The maximum and minimum were about the normal while humidity is below normal by 3·0%. The skies were heavily clouded.

P. V. R. & P. G.

Departmental Notifications.

Postings.

M. R. Ry. D. V. Krishna Rao, Permanent Upper Subordinate Agricultural Section and temporary junior assistant in the Gundlakama scheme—to officiate as Assistant in the chemistry section, *vice* Mr. S. V. Kuppuswami on other duty

M. R. Ry. S. Kanakaraj David, Temporary junior assistant in the Gundlakama scheme to officiate as Assistant in the Chemistry Section, *vice* Mr. P. Satyanarayana on other duty.

M. R. Ry. T. Arunachalam, Agri. Demonstrator, under training in Tinnevelly to be Agricultural Demonstrator, Tiruchendur, with effect from 1—10—37 until further orders.

M. R. Ry. P. Krishna Rao on relief at Hagari will revert as Assistant, Millets section, Coimbatore.

M. R. Ry. G. Ranganathaswami, on the expiry of his leave is posted to A. R. S Anakapalli.

Transfers.

Name of officer	From	To
Mr. C. Vadamalai	F. M. Hagari	A. D. Anantapur.
„ D. S. Subramania Iyer	A. D. Tinnevelly	A. D. Srivilliputhur.
„ P. V. Samu Ayyar	A. D. Srivilliputhur	A. D. Tinnevelly.
„ S. Muthuswami	A. D. Tirumangalam	A. D. Dindigul.
„ M. C. Krishnaswami Sarma	A. D. Dindigul	A. D. Tirumangalam.
„ A. K. Ganesa Ayyar	A. D. (on leave)	A. D. Paramakudi.
„ James Colaco	Asst., Chemistry Section	A. R. S. Sriuguppa.
„ K. Sriraman	Asst., Chemistry Section	A. R. S. Sriuguppa.

Leave.

Name of officer	Period of leave.
Mr. S. V. Doraiswami Iyer, F. M. Guntur	Extension of l. a. p. on m. c. for one month from 27—9—37.
„ C. Annamalai, A. D. Palamaner	l. a. p. for one month from 4—10—37.
„ P. Kannappa Pillai, on leave	Extension of leave on half average pay for 3 months from 4-8—37.
„ B. N. Padmanabha Iyer, F. M., P. B. S., Cbe.	l. a. p. for one month from 5—10—37.
„ K. P. Anantanarayana Iyer, Asst., Entomology Section	l. a. p. for one month from 11—10—37.
„ R. Sankara Iyer, Asst., Cotton Section	Leave without allowance for a period of 12 months from 1—11—37.
„ C. S. Krishnaswami, Asst., Mycology Section	l. a. p. for one month from 11—10—37,
„ K. Bhushanam, Asst., Chemistry Section	l. a. p. for one month from 15—10—37.
„ A. Abdul Samad, Asst. in Soil Physics	l. a. p. for one month from 25—10—37.

ADDITIONS TO THE LIBRARY, SEPTEMBER 1937.

A. Books.

1. *Development, Classification and Properties of Soils.* Scarseth, G. D. (1936). 2. *The Cycle of Weathering tr. by A. Manir.* Polynov, B. B. (1937). 3. *An Introduction to the Scientific Study of the Soil.* Comber, N. M. (1936). 4. *Soil Conditions and Plant Growth. 7th Edn.* Russell, E. J. (1937). 5. *Resisting Drought.* Van Reenen, R. J. (1935). 6. *Mohenjo-Daro and the Civilization of Ancient India with reference to Agriculture.* Chaudhury, N. C. (1937). 7. *Farm Machinery and Equipment.* Smith, H. P. (1937). 8. *The Vegetable Oil Industry.* By An Industrialist. (1936). 9. *The International Grain Trade.* Hooker, A. A. (1936). 10. *The Oxford Economic Atlas* Bartholomew, J. (1937). 11. *Life and Labour in a Gujarat Taluka.* Shukla, J. B. (1937). 12. *Denmark: The Cooperative Way.* Howe, F. C. (1936). 13. *Intermediate Botany.* Sabhesan, M. S. (1937). 14. *Methods in Plant Physiology.* Loomis, W. E., Etc. (1937). 15. *Biological Laboratory Technique.* Gatenby, J. B. (1937). 16. *Mineral Nutrition of Farm Animals.* Mitchell, H. H. & McClure, F. J. (1937). 17. *Second International Congress for Microbiology—Proceedings.* John-Brooks, R., Ed. (1937). 18. *Clinical Diagnostics of the Internal Diseases of Domestic Animals, Tr. by J. R. Mohler.* Malkmus, B. (1936). 19. *Practical Veterinary Pharmacology, Materia Medica and Therapeutics.* Milks, H. J. (1936). 20. *Cheap and Healthy Homes for the Middle Classes of India.* Despande, R. S. (1935). 21. *Graphs: How to make and use them.* Arkin, H. & Cotton, R. R. (1936). 22. *Preparing the Research Paper.* Schmitz, R. M. (1935).

B. Annual Reports.

1. Madras Agricultural Chemist, Entomologist, and Mycologist Administration Reports for 1936-37. 2. Madras Agri-Horticultural Society Annual Report for 1935-36. 3. Nilgiri Agri-Horticultural Society Annual Report for the year ending 31st December 1935. 4. Mysore Coffee Scientific Officer's Annual Report for 1936-37. 5. Madras, Chemical Examiner's (Public Health) Annual Report for 1936. 6. I. C. A. R.—Research Schemes—Special Reports. 6(a). Burma, Rice Research Officer's Annual Report for the year ended 31st March 1936. 6(b). Assam, Deep Water Paddy Research Farm Annual Report for 1935-36. 6(c). Padegaon Sugarcane Research Station Annual Report for 1934-35. 6(d). Padegaon Sugarcane Research Station Annual Report for 1935-36. 6(e). Dacca Sugarcane Seedling Testing Station Annual Report for 1934-35. 6(f). First Report on the Work done under the Scheme for Research on the Genetics of Sugarcane by Dr. E. K. Janaki Ammal. 6(g). Punjab Sugarcane Research Station Annual Report for the years 1934-35 and 1935-36. 6(h). Mushari Sugarcane Research Station Annual Report for 1934-35. 6(i). Jorhat Sugarcane Research Station Annual Report for the year ended 31st March 1935. 6(j). Patna, The Manufacture of Khandsari Sugar by the Open Single Pan Method: Annual Report for 1934-35. 6(k). Mysore, Report of Work Done on the Breeding of Thick Canes in the Mysore Farms during 1933-35. 6(l). Mosaic and other Diseases of Sugarcane: Annual Report for 1935-36. 6(m). Sabour Horticultural Research Station Annual Report for 1935-36. 6(n). Sheep Breeding Industry in Upper Garhwol: Report. 7. Sind: Department of Agriculture Annual Report for 1935-36. 8. Bihar, Indian Lac Research Institute Annual Report for 1936-37. 9. United Kingdom: Agricultural Research Institutes Annual Reports for 1934-35. 10 England: National Institute for Research in Dairying Annual Report 1936. 11. Canada Dominion Grain Research Laboratory Tenth Annual Report 1936. 12. Hong Kong: Botanical and Forestry Department Annual Report for 1936. 13. St. Kitts-Nevis: Agricultural Department Annual Report for 1936. 14. Massachusetts Agricultural

Experiment Station Annual Report for the year ending November 30, 1936, 15. Utah: Agricultural Experiment Station Annual Report from July 1, 1932 to June 30, 1934.

C. Special Publications and Proceedings.

16. The Allahabad Cottage Industries, Bhatty, E. C. 17. The Market and Marketting, Bhatty, E. C. 18. The Reserve Bank and Agricultural Credits. Ramaiya, A. 19. Premikisan (An Agricultural Drama). Md. H. H. Nashter. (Tr. into English). 20. Co-operation: Principles and Practices, Christensen, C. L, Etc. 21. Proceedings of the Conference on Maternity and Child-welfare, 1936. (Madras Health Propaganda Board Pub.). 22. Indian Central Cotton Committee —24th Proceedings—1937. 23. Indian Sugar Mills Association—Annual Report—1935-36. 24. Transactions of the Highland and Agricultural Society of Scotland —1937. 25. Canada Agricultural Department—Summerland, B. C. Experimental Station Results 1932—1936. 26. Agricultural Produce (Grading and Marketing), England: Statutory Rules and Orders No. 632 of 1937. 27. Proceedings of the Association of Land Grant Colleges and Universities (U. S. A.) 1936. 28. Agricultural Research Through Fifty Years 1885—1935. (Minnesota Agr. Expt. Stn. Special Report). 29. Transactions of the Iowa State Horticultural Society for 1936. 30. Official Grades for Fruits and Vegetables in Pennsylvania—1937. 31. Farm Tenancy in Washington: Report of the Committee; and 32. Reclamation: A Sound National Policy. Washington State Planning Council's Publications.

D. Bulletins, Memoirs, Etc.

33. Production of Grass Seed; 34. Insects and other pests Injurious to the Production of Seed in Herbage and Forage Crops; and 35. The Influence of Climatic Conditions on Type Composition. *Eng. Imp. Bur. Plant Genetics Herbage Pub. Ser. Bull. 10, 20 and 21.* 36. Methods for the Chemical Analysis of Biological Material in Nutrition Investigations. *Scot. Imp. Bur. Animal Nutrition Tech. Communication No. 9.* 37. Further Experiments on the Nitrogenous and Phosphatic Manuring of Cotton. *Egypt Royal Agr. Soc. Bull. No. 30.* 38. The Effects of Light and of Oxygen on the Uptake of Sugar by the Foliage Leaf. *Trinidad Cotton Res. Stn. Mem. Ser. B. No. 10.* 39. Citrus Irrigation Practices with special reference to Soil Moisture studies in Two Orchards in the Eastern Transvael. *Union of S. Africa Dep. Agr. Sci. Bull. No. 159.* 40. Veld Management Investigations at the School of Agriculture, Potchefstroom. *Union of S. Africa Dep. Agr. Bull. No. 166.* 41. Report on Soil Erosion in Cyprus. *Cyprus Dep. Agr. Bull. No. 3.* 42. An Economic Study of Potato Production in New Brunswick. *Canada Dep. Agr. Pub. 562, Tech. Bull. No. 8.* 43. Soil Drifting Control in the Prairie Provinces. *Canada Dep. Agr. Pub. 568, Farmers' Bull. 32.* 44. The Influence of Some Factors on the Storage Quality of Eggs. *Arkansas A. E. S. Bull. No. 341.* 45. Chemical Investigations of the Tobacco plant; V. Chemical Changes that Occur During Growth; 46. The Improvement of Naturally Crosspolinated Plants by Selection in Self-Fertilized Lines. II. The Testing and Utilization of Inbred Strains of corn; and 47. The Universal Soil Testing System. *Connecticut A. E. S. Bull. 374, 376 and 392.* 48. Soil and Plant Material Analyses by Rapid Chemical Methods; and 49. Soil and Plant Material Analyses by Rapid Chemical Methods, II. *Hawaiian Sug. Planters' Asso. Exp. Stn. Bull. No. 50 and 51.* 50. Housing Farm Poultry; and 51. Suggestions for Profitable Dairying. *Idaho Univ. Coll. Extension Dvn. Bull. No. 99 and 102.* 52. Milk Transportation Problems in the St. Louis Milkshed. *Illinois A. E. S. Bull. 430.* 53. Manual for Milk and Cream Testers in Maryland. *Maryland Agr. Exp. Stn. Bull. No. 401.* 54. The Effect of Processing on Vitamins in Fruits and Vegetables: A Review. *Massachusetts A. E. S. Bull 1.* 55. Vegetable Gardening; 56. Potato Pointers; and 57. Perennial

Weeds and their Control. *Minnesota Agr. Extn. Dvn. Spl. Bull. 171, 182 and 183.* 58. A Preliminary Report of Livestock Costs and Returns; 59. Tractor Costs and Rates of Performance; 60. Report of a Farm Management Survey of 130 Dairy Farms; 61. Report of a Farm Management Survey of 120 Dairy Farms; and 62. A Preliminary Report of Crop Production Costs. *Minnesota Agr. Econ. Mime. Rep. No. 85, 84, 79, 80 and 81.* 63. Marketing Oregon Fruits: A Review of Economic Conditions Including Trade Practices with Recommendations and Suggestions for Legislation. *Oregon State Agr. Invest. Comm. Report, 1937.* 64. Superheating as a Control for Cereal Mill Insects; 65. Comparison of Some Methods of Growing Onions; 66. Soybeans: Their Adaptation and Production in Montana; and 67. The Effect of Tillage Method, Crop Sequence and Date of Seeding upon the Yield and Quality of Cereals and other Crops Grown under Dryland Conditions in North-Central Montana. *Montana A. E. S. Bull. No. 297, 305, 335, and 336.* 68. Permanent Pasture Studies; and 69. Types of Farming and Farm Business Studies in South Carolina. *S. Carolina A. E. S. Bull. 308 and 310.* 70. Hemorrhagic Septicemia. *Dakota A. E. S. Bull. 307.* 71. A Holding Test at Room Temperature as an Indication of the Keeping Quality of Butter in Storage; and 72. Alkali Disease or Selenium Poisoning. *Brooking A. E. S. Bull. 308 and 311.* 73. Drainage and Irrigation, Soil, Economic, and Social Conditions, Delta Area, Utah. *Utah A. E. S. Bull 273.* 74. Soil Erosion and Stream Flow on Range and Forest Lands of the Upper Rio Grande Watershed in Relation to Land Resources and Human Welfare. *Wash. Dep. Agr. Tech. Bull. 567.* 75. Soil Defence in the Piedmont; and 76. Strip Cropping for Soil Conservation. *Wash. Dep. Agr. Farmers' Bull. 17 and 1776.* 77. Crop Rotations; and 78. Farm Labour in the Yakima Valley, Washington. *Wash. A. E. S. Bull. No 344 and 343.*

E. Leaflets, Etc.

79. Further Observations on Soil Erosion and Sand Drift, with Special Reference to South-Western Queensland. *Commonwealth of Australia Pamphlet No. 70.* 80. Grape Culture in Georgia. *Georgia Agr. Ext. Ser. Cir. No. 265.* 81. Poultry Rations and How to Mix them; and 82. Fumigation for the Control of Household Insects. *Idaho Univ. Coll. Agr. Ext. Cir. No. 44 and 50.* 83. Beekeeping in Kentucky. *Kentucky Univ. Coll. Agr. Cir. No. 288.* 84. Beekeeping in Pennsylvania; and 85. Diseases and Enemies of the Honeybee. *Pennsylvania A. E. S. Cir. 141 and 156.*

F. English Translations of Scientific Articles.

(i) The Groundnut (*Arachis hypogaea*) by Z. Luzina (from Russian). (ii) Monograph on Groundnut by M. Chevalier (from French).

G. New Periodical.

1. The Economic Analyst.

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Report on the work of the Imperial Council of Agricultural Research in applying Science to Crop Production in India.

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SUMMARY AND RECOMMENDATIONS

The Imperial Council of Agricultural Research has admirably discharged its primary duty of co-ordinating and promoting agricultural research in India, at any rate in regard to crop production, with which alone this report is concerned. The Council has been able to arrange that all the factors affecting the production of each of the more important crops should be studied by one group of workers; the results can now be brought together and put into a form in which they can be used by the agricultural officers. A vast amount of pioneering work extending over a wide range has been accomplished.

A stage is now reached where a reorientation of the Council's activities should be considered.

It may be laid down as a broad principle that the investigations fostered by the Council should be for the express purpose of improving agriculture, the great need now is for fuller use of existing knowledge, rather than the accumulation of more knowledge, for work on the cultivators' fields rather than in the laboratory.

The Council's programme should, in my view, be lightened by handing over to the Universities all investigations of a scientific or non-technical nature and setting aside a certain fraction of the grant for this purpose. The grants made by the Council to Universities should be primarily for the purpose of fostering research in subjects allied or basic to agricultural science and practice and for training graduates in research methods, but the investigations should not be required to have an agricultural bearing. So far as research is concerned, it is the teacher and not the subject that counts, and the Council should be empowered to make grants to University Departments where good work is being done so as to provide one or more additional assistants who could subsequently, if needed, be attracted into the agricultural service.

Much of the research in agricultural science done in India is not as widely known as it deserves to be and I recommend the preparation of a series of monographs by competent persons setting forth the results obtained by Indian workers and pointing out how they differ from those obtained elsewhere.

Agriculture in India is not merely an industry but the mode of life of a large part of the population. The scope of the Council's work must therefore be much wider than if the subject were purely a branch of technology.

It is not sufficient for the results of the research work simply to be published in the Council Journal: the Council should have powers to undertake the much more difficult task of arranging for them to be put into practice. The Council should also act as a Development Commission, stimulating extension work by the Departments and commercial exploitation of useful discoveries. This would involve additional staff to take over various duties so as to leave the senior staff free to plan ahead and to think out the problems involved. This extension of the Council's activities would involve additional expenditure necessitating an increase in its grants.

On the other hand Provincial Departments should contribute substantially to investigations made at their Stations on subjects of importance to them.

By far the largest part of the land of India is used for producing food crops intended for home consumption. Investigations on these crops should be made in conjunction with the human nutrition experts who should advise how far existing dietaries are deficient and what supplementary crops, vegetables, fruits etc., should be grown in order to make up the deficiencies in the various regions. The Council's investigations should be directed to increasing the output per acre of foodcrops with a view both of ensuring full supplies and of liberating land for the growth of the supplementary crops and of fodder crops for the production of milk.

This increased productiveness is the main problem to which all others should be subordinated.

Investigations on quality of food crops should be made only at the request and under the close supervision of the nutrition experts except where specific marketing problems arise.

Certain problems relating to various crops should receive early attention.

Wheat:—In view of the fact that the export trade has fallen considerably and the home consumption increased, a decision should be reached as to the future policy. If the recapture of the export trade is proposed then vigorous steps must be taken to increase largely the area under those varieties acceptable to the modern English

market. If, on the other hand, the home market is to be the chief consideration then the varieties should be tasted for their suitability to the local mills and the making of *chapatis*, actual cooking tests being used.

Barley—Recent developments in the United States suggest that Californian 6—rowed barley may not be available on the English market in such large quantities as hitherto, and this may create a good opening for Indian barleys. The varieties placed high on the list by the Institute of Brewing should be grown on a sufficiently large scale to ensure adequate supplies for the development of a permanent export trade. The export of cheap barley, however, should not be encouraged owing to its high content of protein which has considerable value in India.

Vegetables: Every effort should be made to extend the cultivation of potatoes and other vegetables, particularly of the more hardy kinds, the list to be drawn up in conjunction with the nutrition experts.

Fruit. The hill regions offer considerable scope for the ordinary English and Mediterranean fruits, and the plains and the Peninsular for tropical and subtropical fruits—mangoes, citrus, bananas and others. The cultivation of fruit should be extended where possible and distinction could be made both in experimental work and in action between production for the village and production for the market. Much confusion in regard to varieties needs straightening out; methods of propagation have to be developed, and above all supplies of young trees true to type must be worked up for distribution.

Along with fruit growing for the market go various subsidiary industries, especially fruit preservation and the making of containers, besides minor activities such as bee keeping and poultry keeping, both of which go well with fruit growing.

Transport is however, a usual limiting factor and this should be improved wherever possible.

Grass and Fodder Crops; 1. *Grass.* The reports on nutrition lay great stress on the need for augmenting the milk supply and this resolves itself finally into an increase in the amount of grass and fodder crops available. Some 10 per cent of the livestock population have to depend on forest grazings. Various difficult problems of administration, soil erosion and deterioration of herbage are involved, and I recommend that the Council call for a report by a forester, an animal husbandry expert, and a soil expert making recommendations for improving and developing these grazings and that the council should urge upon the proper authorities the need for taking active steps to carry out these recommendations.

The other grazings, which provide for some 90 per cent. of the stock, should form the subject of a second report on which action

should be taken. They include a very wide range varying from fairly good grassland down to virtual waste land. Improvement may be possible by reseeding, selecting for this purpose varieties and strains of indigenous grasses, and introducing drought resistant varieties from Africa such as the Woolly Finger grasses, *Digitaria seriata* and *D. Pentzii.* More experiments on management are also needed : on rotational grazing, the effect of period of the year and of manuring : these all require that the land should be enclosed. Experimental work on this subject should as far as possible be done on actual grazing land.

2. *Fodder Crops.* Where water is available fodder crops can be grown and they not only provide food for the animals but indirectly increase soil fertility. Berseem is particularly useful and steps should be taken to increase the seed supply : the North-west Frontier Province appears to be a suitable source. Napier grass has done well and other fodder crops deserve investigation. The possiblity of silage making should be further examined. The more intimate fusion of agriculture and livestock husbandry is one of the most hopeful ways of improving Indian agriculture.

The improvement of farm implements, and particularly of the bullock cart would reduce the need for the present large animal population and so enable the remaining animals to be better fed.

Cash Crops. The investigations on cash crops should be done in close association with expert users and buyers of the crops. Good example of close co-ordination are afforded by the Tea Research Institute, Tocklai, and the Cotton Research Laboratory, Matunga. Malting barley is also adequately dealt with. On the other hand the arrangements for wheat and rice are less satisfactory ; in neither case is the purpose of the work sufficiently definite. It is necessary to decide on the market for which the experimenters are to cater, and then to associate competent market representatives with the enquiry.

The investigations on sugarcane are on sound lines : most of this crop is used for making gur in the villages, and the experiments on the improvement of the mills and evaporating plant (including the furnace) should be pushed forward with the aid of competent engineers. Experiments on factory technique are carried out at the Harcourt-Butler Technological Institute, Cawnpore.

Broadly speaking it seems undesirable for the Council to undertake technological investigations and the new Sugar Committe could quite properly carry on this work.

Some way should be found out of the present difficulty of putting into factory practice the results obtained in the various technological investigations at the Sugar Research Institute, at Dehra Dun on forest products, and elsewhere. The difficulty in India is not so much to discover or to invent, as to exploit.

Other Crops. The possibility of extending cultivation of cinchona and insecticidal plants should be discussed with the scientific officers of the tea and coffee plantations, especially as the former are limiting their areas under tea as a result of trade agreements.

Methods of increasing the output from the land. 1. *Improved varieties.* The finding of new varieties by selection and breeding is in general very well done: it is indeed some of the best agricultural work in India. It is necessarily localised because the varieties best suited to one place may not be best suited to another: and it is continuing work because no selection can ever be final. It has now in the main passed beyond the research stage and become essentially a combination of routine operations more suited to the Provincial Departments than to the Council. Nevertheless the Council will always have an important part to play. It is the only body with full knowledge of all the material available for work on breeding or selection of crops; and it is in a position to arrange for exchange of material and to decide what work in a provincial Department should continue to be carried on if some financial stringency threatened to endanger a useful investigation.

More work is needed on the millets, the pulses, and the oil seeds.

The work would be put on to a less mechanical and more definitely scientific basis if it could be associated with a first class geneticist, good enough to command the respect of the men now engaged in the work, and to be accepted by them as a leader. Unfortunately no man of this type is at present in sight.

Improved varieties have not been widely taken up, except of sugarcane and jute partly because of the difficulty of obtaining seed. I recommend that the Council enquire into the methods of distribution adopted in the various Provinces and States, and consider the desirability of finding means for speeding it up.

2. *Better control of pests and diseases.* In general each of the more important groups of crops should have its own staff of entomologists and plant pathologists: cotton, sugarcane, the food crops, each presents special features and no one man is likely to succeed with all. Surveys should be made to ascertain which pests are increasing and which are decreasing and to collect material for ascertaining the effect of conditions on the intensity of attack. When these are known it becomes possible to see how far changes in conditions or methods will obviate the attack. Direct control by chemical means is sometimes the only possible method, and the work on vegetable insecticides should be continued with some modification of programme. Biological control presents various difficulties, but should be studied.

In view of the importance of insect pests in India, and the need for finding means of control, I recommend that a visiting expert of

high standing be called in to advise as to the most suitable types of measures to be taken.

The search for resistant varieties must always continue, it is more useful for fungus diseases than for insect pests and in any case it is not final: so called "resistance" often means only that another variety growing close by is preferred ; and even actual resistance may break down.

It is very important, however that some central authority should have power to deal administratively with plant diseases and pests for the whole of India. With increased speed of transport it is almost impossible to keep out disease organisms from other countries but it is far easier to deal with an invader at an early stage than to wait until it has spread into every Province.

The Council, however should not be concerned with the executive control of diseases and pests: its duties should be to arrange for research and advice into the most suitable means of dealing with them.

3. *Improvement of the water supply for crops.* This is one of the most important of all agricultural problems in India and perhaps the most difficult. It is too big to form part of a programme, and I recommend the establishment of a Central Irrigation Station for all-India where the agricultural problems can be worked out. At this station the relations of soils, water and growing crops would be studied, also the interaction between salt water and soil, the reclamation of salted and alkaline land, the movements of subsoil water, and the agricultural effects of various sequences of crops.

Provision should also be made for more complete co-ordination of the investigations on dry farming and for linking it up with the work of the proposed Irrigation Research Station.

4. *The Conservating of Soil Fertility.* (a) *The prevention of erosion.* While further research on soil erosion should continue, the chief need now is for action rather than for more research. Protection against erosion should be State responsibility and each erosion area should be dealt with as a whole. An Erosion Conference should be held annually at which forestry, animal husbandry and soil experts meet the agricultural officers and advise as to what measures should be taken ; the appropriate Minister should then have power to carry out these measures and to distribute the cost over the lands protected.

(b) *Manuring.* More systematic schemes of manurial trails are necessary in order to test the relative values of nitrogen in artificial ferilizers, farm yard manure and composts, and the values of phosphate and potash. Simplified schemes should be carried out on cultivators' ground so as to discover what new factors, if any, come

into play there and to find also how far the stations results hold generally.

Green manuring should be more systematically studied.

A report on the manurial trials fostered by the Council should be drawn up by the Statistician, with recommendations for a more systematic treatment. If they can be obtained, the results of the extensive trials carried out recently by the large fertilizer organisations (Imperial Chemical Industries : the Potash Syndicate) should be included in the survey.

Next to an improved water supply an increased supply of farmyard manure should probably do more than anything else to augment the output from the land. Additional supplies of fodder crops would add to the amount of farmyard manure, but the surest way of doing this is to reduce the necessity for burning it by providing alternative sources of fuel. The Forest Department should be consulted as to suitable ways of planting tree belts that could provide shelter, fodder and fuel, and protection against erosion and dust storms.

The Special Difficulties of Indian Agriculture. One of the most serious defects of Indian village life is the absence of an educated middle class actually engaged in farming. Students from Agricultural colleges, who might be expected to form this class, do not take to farming, but strong efforts should be made to induce them to do so. The experiment of establishing Colony villages in the canal areas of the United Provinces seems to offer one method of solving the problem. Generally speaking specialised farming such as cotton growing, fruit farming, seed production, etc., afford better prospects for a trained man than ordinary farming.

The Co-operative movement can hardly be expected to achieve as good results as in Denmark owing to the wide difference in conditions. The experience of Bombay and the Punjab is, however, that something can be achieved if there is firm guidance from outside, and probably suitable modifications in this direction can be devised.

The consolidation of scattered and fragmented holdings is so important that officers found to be successful in arranging it should be encouraged to remain at the work and should not be under the necessity of seeking advancement in other directions.

Owing to the importance of fruit and vegetable growing in the villages, and the desirability of planting more trees, school teachers should be encouraged to take up gardening and to undertake some of this planting with the children. Where possible, a school garden should be established.

The insufficiency of subsidiary industries is a well recognised weakness of Indian village life : the cultivator has long slack periods during which, if he had the opportunity, he might be increasing his

income. An expansion of the cropping scheme should be arranged to utilise some of this time. Poultry keeping offers some possibility of success over a wide area as shown by the results of Mr. A. E. Slater in the United Provinces and of Dr. Hatch at Martandam in Travancore ; beekeeping is possible in the hill regions. The ideal occupation would be cottage industries but apart from weaving and a few localised industries, these are hampered by the very difficult problems of marketing.

Bridging the Gap between the Experiment Station and the Cultivator. By far the most important and most difficult task before the agricultural officers in India is to bridge the great gulf separating the agricultural experiment stations and the few large scale farmers from the peasants who cultivate by far the largest proportion of the land. It is not new science so much as fuller use of existing science that is needed, and the Council should order an enquiry to discover how best this could be done and to urge upon the proper authorities the need for taking all steps possible to this end. The extension officer should be recognised as a very important member of the staff and really competent men should be encouraged to continue at the work and be under no necessity to seek promotion out of it. The possibilities of broadcasting should be tested and means should be devised for the rapid answering of enquiries that have come in as a result of the talks. It should be impressed upon the staffs at the experiment Stations that they have a responsibility to the cultivator ; that they must not shelter themselves within the walls of the laboratory in the hope that somehow their work may find practical application; they must make the field and the crop their centres, and as early as possible set out experiments on cultivators' land so as to widen the scope of their enquiry.

Demonstrations should be made by means of holdings taken as a whole in addition to those on individual plots, and the staffs of the experiment stations should be expected to carry out simplified forms of their experiments on cultivators' land unless there was good reason to the contrary.

The Imperial Agricultural Research Institute, Delhi. The Institute both because of its tradition and in virtue of its equipment should take a leading part in agricultural research in India. It can best accomplish this by working in close collaboration with the Imperial Council of Agricultural Research which, as the actual agent for the co-ordination of agricultural research in India, should be in a position to require the inclusion of specified items in its programme of work. Among other important subjects which could be handed over to the Institute are the devising of statistically sound methods of sampling soils and crops for approximate and accurate investigations

respectively ; the collection and collation of the results of the numerous local soil surveys that have been made ; surveys of insect and fungus pests and of physiological and other diseases. In carrying out its own programme the Institute should carefully avoid the common faults of keeping the work too much in the laboratory ; it should centre its investigations on the field and it should study a few problems thoroughly rather than a larger number superficially.

The Staff. Suggestions are made in regard to training and qualifications of staff; and the difficulty of finding good leaders is emphasised. Good officers who excel in either research, extension work, or in persuading cultivators to consolidate their holdings, should be kept at their work and should not be compelled to seek promotion outside of the sphere in which they have proved their capacity for success. Although the Council's schemes are by their nature temporary the research staff should after a probationary period be given certain advantages of permanence ; in particular a provident fund scheme should be set up for them, a register of competent workers should be maintained so as to help the men to find other posts, and a permanent cadre of selected workers of proved merit should be formed for the purposes of carrying out investigations wherever this might be necessary.

The Improvement of the Village. The efforts to improve agriculture are likely to be unavailing unless the villages are improved and made fit for good cultivators to live in. This work has a deep personal side and could never be accomplished without enthusiasm and the missionary spirit ; but it needs a solid foundation of accurately determined knowledge, and careful impartial consideration of the probable effects of proposed measures. The Council could probably better than any other body arrange for this to be done by organising surveys or other enquiries.

It should also arrange for a Report on methods of effecting consolidation of holdings and of cropping, and consider what steps could be taken to hasten these changes.

General Recommendations. (The detailed recommendations relating to the research schemes are given under each section).

1. The success of the Council's efforts shows that its general organisation and research programme are both sound and that it is a very effective agent for the improvement of Indian Agriculture. My proposals are for an extension of its activities but always with the same purpose ; increased production from the soil of India.

2. An organised research scheme implies a definite plan for agricultural improvement and means of ensuring that the results of the research work are put into practice. I recommend therefore that the powers of the Council be widened to comprise developmental activities as well as research activities.

3. The work on crops sold in the open market (cash crops) should be done in association with the expert buyers or users of the crop. As a crop becomes of sufficient importance it should have its own committee and specialist staff as now happens for cotton and jute and will soon be the case for sugar.

4. The work on crops mainly retained for food (food crops) should be done in association with the nutrition experts, who should advise as to the most suitable means of making up deficiencies in diet. The Council on its Developmental side should arrange for the recommendations to be put into practicable form. A survey showing broadly the quantities of food produced in the various provinces should be made so as to provide a basis for joint action by agriculturists and nutrition experts in improving the schemes of food production in the villages. The newly appointed laison officer between the Agricultural and the Health (nutritional) departments could be of a material assistance in this work.

Fodder and grazing committee should be set up for each Province so as to examine the possibility of increasing the food supply for animals.

5. Part of the Council's funds should be used for promoting scientific research at the Universities on subjects basic to the science and practice of Agriculture. This financial aid however should be essentially personal, it should be given only to enable an investigator of proved capacity to develop further his own main line of research. No question of possible practical value should be raised; in training for research it is the man and not the subject that matters.

6. On its developmental side the Council should have resources:–

(1) to put into practical form the dietetic recommendations of the nutrition experts;

(2) to stimulate activities directed to the bridging of the gap between the experiment station and the cultivator;

(3) to plan extensions of dairy husbandry, fruit and vegetable growing, poultry keeping and other specialised branches of agricultural production in relation to transport and marketing facilities and to co-operate with the Departments in putting them into practice;

(4) to arrange for the setting up of organisations for the multiplication and distribution of approved stocks of seed, sets and fruit trees;

(5) to advise the Government in regard to other action that could usefully be taken for the improvement of agriculture or the avoidance of some impending loss of soil, crop or market;

(6) to arrange for the exploitation of results of commercial interest obtained at the research stations, e. g. the conserving of fruit and vegetables.

7. The Council should set up a Soil Conservation Committee whose functions would be :—

(1) to arrange for the collection and collation of results of manurial trials and for the putting into practice of suitable results ; the co-operation of the experimental staff of the large fertilizer organisations being if possible secured for this purpose ;

(2) to watch closely regions liable to erosion calling periodical conferences of the Departments concerned, with a view to working out schemes based on the physical rather than the political boundaries ;

(3) to arrange for the collection of results of soil analyses and the accumulation of material for a soil map of India;

(4) to help Departments where necessary in making surveys in irrigated regions or wherever salt or alkali may cause trouble so as to ascertain whether or not it is spreading; to arrange also for reclamation of deteriorated soils;

(5) to examine the cultivable waste lands and report how far they can be better utilized.

8. The Council should call for a report by an agrostologist, a forester, an animal husbandry expert and a soil expert, under the chairmanship of the Agricultural Expert to the Council, on the grazings available in each Province and on the methods of improving them; it should then encourage appropriate action.

9. The Council should set up a Crop production Committee whose function should be :—

(1) the consideration of the cropping schemes, much on the lines adopted by the Crop Planning Conference, with a view to advising about desirable extensions or curtailments of areas under particular crops, improved sequences or rotations, fodder crops, etc;

(2) the general oversight of the programme of research work on crops and examination of the results ; the framing of schemes for putting accepted results into practice:

(3) the organisation of watching services to report on the incidence of insect and fungus pests, noxious weeds or other threats to crop production and to arrange for the working out of control measures with the help of some visiting expert if necessary. The Council would then advise the Government as to any steps that should be taken.

10. In view of the supreme importance of water to the growing crops I recommend the establishment of a separate Research Institute for the study of irrigation and water relationships to soils and crops; also of more unified direction of the work on dry farming.

11. None of these proposals can attain much success unless the standard of country life is raised and this necessitates the settlement of more educated men and women on the land. An enquiry should be made as to the working of the various colonisation and settlements experiments in the Punjab, the United Provinces, and elsewhere and steps taken to institute large scale trials of promising methods. The influence of a colony of good cultivators on the surrounding district would be out of all proportion to their number.

12. The machinery at the disposal of the Council for carrying out this work should consist of :—

(a) the Imperial Agricultural Research Institute, Delhi which should work in close co-operation with the Council, and whose programme would largely be determined by the problems confronting the Council :

(b) A Marketing branch;

(c) a cadre of proved investigators, selected gradually from among the temporary staff now engaged on the Council's schemes; these men would be sent to various stations to deal with difficult problems for which the local resources were inadequate;

(d) a staff of temporary investigators as at present. I recommend, however, that their status be improved by setting up a Provident Fund and by establishing a register of approved persons which should be available to Departments, organisations or private employers wanting scientific workers.

13. These recommendations if carried into effect will necessitate an increase in the grant made to the Council. I see, however, no alternative to the acceptance of this situation. The Council is the co-ordinating agency which provides invaluable assistance to the Provincial Agricultural Departments and will afford still greater help if it is given the wider developmental powers that will enable it to bring to fruition investigations which at present stop at the experimental stage. These departments between them spend over 200 lakhs of rupees annually, a large sum and yet it amounts to little more than one anna per acre sown. The Council's regular grant of 5 lakhs is augmented for various purposes but its income is in my view inadequate for this its important duties and the need for additions to its resources should be recognised at any rate for the next few years, if progress is to be made as rapidly as desired.

A SIMPLE METHOD FOR PREPARING CUBE JAGGERRY FROM LOW QUALITY SUGARCANE JUICES

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It will be within the experience of almost all the cane growers in the district of Coimbatore and round about that low quality juices from badly lodged, diseased or insufficiently irrigated canes often fail to form into the usual cube-shaped jaggery that is so popular in these markets. It is usual in such cases to make the jaggery into big lumps weighing about 2 mds. each. These lump jaggeries are, however, held at a discount in the markets of Coimbatore, Madura, Malabar, and Tinnevelly as they are usually associated with low quality. It is, therefore, the aim of every cane grower in these districts to convert his whole crop into cube jaggery, if he can possibly manage it. The development of a simple process for arriving at this result should accordingly be a matter of some importance to the cane growing ryots of these areas.

Difficulty in making cube jaggery is encountered ordinarily when the juice is of about a purity of 80% or thereabouts. To prepare cube jaggery in such cases, it is the usual practice to add a large excess of lime to the juice both before and during boiling. The result is often successful ; but the colour of this product is dark and unattractive. When the lime is added in moderate quantities, cubes do not form.

In trying to devise a process for overcoming the above difficulty, it is essential to examine critically the local method of jaggery making with a view to remedy any apparent defects found therein.

In the preparation of cube jaggery, the syrup is usually concentrated to such a consistency that a sample of it when dropped into cold water solidifies to a brittle mass. The pan is removed from the fire and the contents stirred slowly and steadily till sugar crystals begin to appear. The crystallised mass is then transferred to the proper mould board and after cooling, the solid cubes are thrown out by striking hard on the top of the inverted mould board.

When the original juice is of high quality having a purity of about 90%, the crystal formation takes place within 5 minutes after removal from the fire. With juices of moderate purity viz., about 85% it takes about 10 to 15 minutes for the crystals to make their appearance. When the juices are of much lower purity say about 80%, the crystallisation does not occur even after half an hour by which time, however, the mass becomes cooled and so viscous that it is no longer fit for charging into the usual mould.

The problem, therefore, seems to resolve itself into one of devising a simple method to make the thick syrup crystallise in time. As is well known, crystallisation of sugar from a supersaturated sugar solution is, apart from its purity, largely dependent upon the temperature and the viscosity of the syrup. The greater the temperature and the lower the viscosity, the more rapid is the formation of crystals.

It has also been found that the greater the temperature to which the sugar solution has been heated in the preparation of the syrup, the greater is the time required for the subsequent formation of crystals.

On a consideration of the above facts, it would appear that the local practice suffers from the following two drawbacks.

(1) The juice is concentrated to too high a consistency.

(2) The thick syrup is cooled down rather at too rapid a rate.

These two factors apparently operate together in delaying the formation of crystals from the concentrated syrup and it was felt that suitable modifications regarding the two operations mentioned above would solve to a certain extent the difficulty in question.

A series of experiments were accordingly tried with low purity juices on the laboratory scale, varying the striking temperature from 118° to 124°C and altering the process of cooling in various ways. It was found for juices of low quality that a temperature of about 122°C was the optimum to which they may be heated for preparing cube jaggery. Crystallisation from the thickened syrup was found to be considerably hastened when the rate of cooling was slowed down. This was carried out as follows.

The pan with its contents on removal from the furnace is placed in hot water kept at a temperature of 80°—90°C and the contents stirred gently from time to time. In about 20 to 30 minutes crystals begin to appear when the crystallised mass may be transferred into the mould and cube jaggery obtained in the usual way.

The modified method has been invariably found a success whenever cube jaggery could not be obtained by the usual process.

Recommendations. (1) The juice should not be concentrated to too high a consistency. The pan may be removed from the furnace when the temperature rises to about 122°C. This roughly corresponds to the consistency required for making lump jaggeries ; (in vernacular, to the உருண்டைப்பதம் of the local jaggery boilers).

(2) The rate of cooling of the thick syrup may be slowed down by placing the pan in hot water kept at 80°—90°C and stirring the contents gently from time to time.

(3) On the appearance of crystals, the mass may be transferred to the mould board and proceeded with in the usual way.

In this connection, it will not be inappropriate to make a mention of the great usuefulness and convenience of the new mould board that has recently come into use in this district. It is, no doubt, a great improvement on the ordinary mould and differs from the latter in having the conical cavities open at both ends. The lower ends of these are, however, closed with movable wooden pegs, of suitable size and these pegs are prevented from falling out of the cavities by small nails driven into them crosswise. On charging the mould with the crystallised syrup and on turning it over after a few minutes, a slight pressure on the pegs causes the whole of the solidified jaggery to drop down in perfect condition.

When using the new board there is no need for the hard and severe hammering that is required to throw out the jaggery cubes from the old mould board and there is, therefore, no doubt that the improved mould board should last considerably longer than the ordinary one.

A NOTE ON THE INDIAN JUTE INDUSTRY

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Among the textile fibre crops of the world jute comes next to cotton and flax in commercial importance. The English word 'Jute' probably derived from Sanskrit '*jhat*' or '*jhout*' meaning "to be entangled" seems to have been in use since the middle of the eighteenth century but its mention for the first time in customs list was about the year 1828.

Jute is cultivated in Bengal from comparatively remote periods for its fibre from which coarse cloth for wear and cordage used to be made. The possibilities of this crop in international trade either being not well understood or more possibly an organised endeavour for its development on a commercial scale not obtaining, jute cultivation and jute manufactures remained in a primitive condition until in the first quarter of the last century, when, with the development of export trade of food grains, the need for a general packing material was keenly felt and jute bags were found handy enough to meet the situation. From that time onwards jute fibre came into the market and began to be exported to Europe and in particular to the Dundee mills in Scotland, chiefly through the efforts of the East India Co. Thus with the opening up of foreign market and the subsequent increased application of the fibre, the jute industry of Bengal came into prominence and grew to phenomenal proportions by the end of last century. Since then, and side by side with the increase in cultivated area, several jute manufacturing and exporting concerns were also established on the banks of the Hooghly.

To the Bengal ryot jute cultivation continued to be so attractive and remunerative that he freely put paddy fields under jute and by the year 1928 there were nearly a million cultivators with an area between 3½ to 4 million acres in Bengal and in parts of the adjoining provinces of Assam, Bihar and Orissa, capable of a moderate fibre outturn of 12 million bales of standard weight of 400 lbs each. The relative export value of jute, raw and manufactured, is nearly one-tenth of the total exports of all the other Indian commodities.

The following additional points make the history of the Indian jute industry more complete, cogent and interesting. The unique place of Bengal as the world's chief jute producing centre is too well known to need emphasis. The significance of this industry as an integral part in India's national economy in general cannot be more emphatically described than in the words of Sir T. V. Acharya :— "How many people outside Bengal are aware of the vast importance of the jute crop in the Indian national economy ? What percentage of the readers of 'The Hindu' realise that in 1934 jute and jute products were the second largest item of India's exports, and that in 1935 they were the largest, even cotton and cotton goods coming down to the second place ? Think of what it meant for India in a year of depression to get for her jute a sum of nearly thirtyseven crores of rupees from foreign countries.

"To the poverty-stricken cultivator of Bengal, jute, ever since the Crimean War when the world was cut off from Russia's flax supplies, has been a veritable silver shower from the skies. In bumper years, before the catastrophic fall in agricultural prices that dates from the autumn of 1928, jute has brought as much as 70 crores to the ryot, a sum which if distributed among the population of Bengal would give a dividend of Rs. 15 — to every man, woman and child." Such is the proud privilege of Bengal which produces 90 per cent of India's raw jute and over 80 per cent of world production. But this position was not attained so easily as one would imagine. For the pioneers of this industry had to surmount a good deal of initial difficulties to introduce and popularise jute yarns in the West where prior to 1835 jute was " looked upon with suspicion by users of linen goods," which bore the guarantee seal " warranted from Indian jute". Thus the early history of this industry was one of dire competition with the other well known and copiously used textile fibres like flax and hemp which were gradually suppressed almost to extinction.

From the first inception of a power loom jute factory of 192 looms in 1859 on the banks of the Hugli, the Calcutta Jute Mill industry steadily progressed in three quarters of a century until in 1933 over 60,000 looms were under operation in the whole of Bengal. A little more than 50 years ago the managing agents of the various mills constituted themselves into a body now known as the Indian

Jute Mills Association (which is virtually a jute fraternity) with a view to protect and promote the interest of all those engaged in this industry.

Although Bengal grows practically the whole of the jute supply of the world and the jute export trade is a significant source of revenue to India, the world wide economic collapse since 1930, coupled with over-production naturally created great anxiety in those concerned in this gigantic enterprise. The slump compelled the associated mills to reduce working time by about a third, sealing down 15 per cent of the total looms and the universal adoption of a single shift working with a consequent slow retrenchment of 21 per cent of the workers, a half of which were women employees—all this calculated to bring supply into line with demand. " The effect of the fall in jute prices on the economic life of Bengal has been of tremendous severity and the result has been described............as something approaching financial paralysis in the province."

The Department of Agriculture was not slow to take cognisance of the situation and to launch schemes of propaganda among the cultivators to restrict the area under jute cultivation and to advocate alternative crops like sugarcane, tobacco, groundnut, linseed and the like. Such intense propaganda together with voluntary restriction resulted in the reduction of the total jute area by about one-half before 1934 and the position is but hesitatingly improving since 1935 as would be seen from the final forecast figures of the jute crop for 1936, viz, 2,180,800 acres with an estimated yield of 7,774,500 bales for Bengal and 364,800 acres with an yield estimate of 961,300 bales for Assam, Bihar and Orissa together.

The price of jute fibre is subject to wide fluctuations due to " forward speculation ". In 1936 the price per bale of " Firsts " was on an average Rs. 32 which is slightly less than a third of the highest price realised in 1926. During the years 1927—'30 the price ranged from Rs. 85 to Rs. 65 per bale. The present low price level notwithstanding, as it is only a passing phase and India still remaining the cheapest fibre producer most suitable for general packing and transport requirements, the industry is bound to come into its own before long. For it is highly important to remember that " several countries have experimented in the growing of jute, but nowhere outside India has it proved a success ". The chief management of this industry as represented by the Indian Jute Mills Association, " while enthusiastically trying to retain the existing trade, are also initiating a policy of research with the object of discovering fresh market and new uses for Indian jute ".

The United Kingdom, Germany, France, Italy and Belgium are regular importers of Indian jute for purposes of converting it into piece-goods, bags, carpets, rugs and other sorts of jute goods which

are placed on the market. Regarding other new uses successfully attempted in a competitive spirit by manufacturers at Dundee are "the use of jute goods to the linoleum and furnishing trades, to the tailor trades, to the boot, shoe and slipper trades, to the cable industry, and for various other purposes, including even road making". (Murray.) Thus the opportunity for the wide application of this material and the expansion of the industry looks very bright, even in spite of the policy of economic nationalism and the encouragement of research on the development of new packing materials in countries like Poland, Italy, Egypt, Chile etc. No wonder then that in pursuance of the recommendations of the Royal Commission on Agriculture the Indian Central Jute Committee has been constituted early in 1936—a distinct land mark in the annals of this industry—"to deal with the interests of all the branches of the trade from the field to the factory. The functions of the committee would be to undertake agricultural, technological and economic research, the improvement of crop forecasting and statistics, the production, testing and distribution of improved seed, enquiries and facilities relating to banking and transport facilities and transport routes and the improvement of the marketing." (Review of Trade in India 1935—36). This Committee which is now financed by the Imperial Council of Agricultural Research has commenced to function actively and is shortly appointing a Jute Specialist at Dacca.

After having thus surveyed the history and the importance of the industry in India some aspects of cultivation of the crop, extraction of the fibre, etc., are briefly outlined in the following paragraphs.

The jute plant (Jew's Mallow) belongs to the Natural Order Tiliaceae. *Corchorus capsularis* and *C. olitorius* are the two chief species under cultivation for fibre. There are many cultivated races belonging to both these species. Races of C. capsularis which have short, round fruits are largely preferred to those of C. olitorius which have long cylindrical fruits, because, it is said, they are more tolerant of adverse conditions, such as water-logging or submersion or high temperature with the added advantage of better fibre yield.

The season for cultivation of this crop commences from mid-February or early March and ends in September or early October. The period from sowing to flowering is only three and half to four months when the crop is usually cut for fibre. With the first precipitation fields are ploughed several times to a fine tilth and while there is adequate moisture in the soil seeds are sown broadcast cross-wise to ensure even distribution of the seeds using a seed rate of about 10 lbs. to the acre. The sown area is harrowed to cover the seeds, and compacted, if necessary, to retain moisture and help germination.

Viable seeds complete germination in 3–5 days. Subsequent cultural operations are thinning once and weeding as often as necessary

and practicable. A month old seedlings are thinned down to a fairly uniform spacing of about 4 inches to 6 inches between plants. More space is not generally allowed as it will encourage branching which affects fibre yield.

Silt-renewed alluvial or loamy soil is typical for jute cultivation. As for the manurial requirements of this crop application of cattle manure at 5 tons or castor cake at 7 mds. (82 lbs per Md.), per acre is considered ample. Other concentrated fertilisers need not be resorted to under ordinary circumstances, though jute responds well to liberal doses of them in combination with the natural bulky manures. Manuring to improve the fertility of large portion of areas lying enmeshed and inundated by the Ganges and the Brahmaputra rivers and their branches and tributaries is not a serious necessity. Elsewhere liberal application of manures such as dung, house sweepings and ashes is justified better. Green manuring with any suitable crop is also beneficial in areas not liable to submersion. A crop of cold weather paddy after jute is an excellent economic rotation and in that case manuring the jute crop is a sound policy. Jute is said to be an exhausting crop and it is interesting to remember that the fibre being purely a non-nitrogenous substance, the actual drain on the mineral substances of the soil is caused by the non-fibrous portion of the plant. Jute dislikes alkaline lands but tolerates temporary water-logging.

Jute is harvested with hand sickles immediately after flowering or just when seeds are set and sometimes, though rarely, later. But it is best to cut the crop in the first and second stages as then it yields fibre of superior quality. With further maturity it may yield a little more but then that fibre is weaker and inferior. Usually each cultivator leaves a patch of the crop to mature for seeds, for the next crop.

Retting, stripping and washing constitute a set of operations in succession following harvest by which fibre is extracted and prepared for the factory. Each of these processes is simple in technique but delicate and difficult in practice and has to be done skilfully and dexterously. For this the plants are made into small bundles and stacked in the open for a few days when the leaves whither and drop off. Getting rid of the leaves is necessary as otherwise they merely add to the bulk and hinder the progress of retting and also spoil the water. These bundles are then steeped in deep clean and clear water for varying periods from 10 days to even as long as a month depending mostly on the maturity of the crop. During this time the bark gets softened and loosened from the central core. When large heaps are immersed the inner bundles ret easier and earlier which, if left longer than necessary under water, will over-ret. The appreciation of the correct degree of retting is highly essential and is born of experience. By under-retting the fibre gets gummy and by over-retting it loses its essential qualities viz., strength, gloss and colour.

Retting is in reality a process of fermentation during which the tissue in which the fibre is embedded is softened and deteriorated. It can be artificially expedited by the addition of ammonium salts or the salts of phosphoric acid in small quantities to the water. Such artificial hastening though not ordinarily required is sometimes resorted to as a measure of expediency, such as to meet urgent market demands especially during competition and late harvest.

The process of stripping or separating the fibre from the stem and washing and cleaning it is described by Royle as follows:—"The proper point being attained the native operator standing up to his middle in water takes as many of the sticks in his hand as he can grasp, and removing a small portion of the bark from the ends next to the roots, and grasping them together he strips off the whole with a little management from end to end without breaking either stem or fibre. Having prepared a certain quantity into this state, he next proceeds to wash off; this is done by taking a large handful; swinging it round his head he dashes it repeatedly against the surface of the water drawing it through towards him, so as to wash off the impurities; then, with a dexterous throw he fans it out on the surface of the water and carefully picks off all remaining black spots. It is now wrung out so as to remove as much water as possible and then hung up on lines prepared on the spot, to dry in the sun."

When completely dry lots of the fibre are pressed and packed into standard bundles of 400 lbs. each. A moderate out-turn of such finished fibre may be 1,200—1,500 lbs. from an acre which is about 4—5 per cent of the green weight of the entire crop at harvest. The fibre must be packed damp-proof and stored somewhat loosely in ventilated godowns lest the somewhat hygroscopic fibre should swell, "sweat" and deteriorate.

Characteristics of good fibre are light colour, 4—6 feet or more in length, freedom from dirt and spots, and durability. Of the several commercially recognised varieties of jute fibre each having some distinct qualities and indicated through different trade marks the following are popular in the market.

1. *Serajgange* (*Deswal*)—soft, fine and strong, light grey in colour.
2. *Narainganje*—soft, long and strong, reddish.
3. *Deora*—somewhat coarse and inferior to 1 and 2.
4. *Desi*—moderately strong and dark in colour.

The several articles of use that could be made with jute have been incidentally mentioned before and need not be repeated here.

The unique place of Bengal and portions of the adjacent provinces constituting a jute growing zone, as it were, in India is due to the existence of ideal conditions for the cultivation of the crop and consequently the development of the manufacturing industry such

as—a high temperature (between 60° and 100°F), fertile deep soil capable of moisture retention, a well distributed minimum rain-fall of 50 inches per annum, fairly cheap labour, availability of plenty of clean clear water for retting, and transport facilities.

Absence of any one condition or a combination of them is a serious handicap in the spreading of jute cultivation outside this zone on a large and competitive scale. And there does not seem to exist any published record of a remarkable success of this crop outside this area where its substitutes Bimilipatam jute, crotolarias and agaves, probably because of their greater adaptability are grown in large acres. But, on reading Finlow and Mollison on the extension of jute cultivation in India one wonders why the jute industry could not be given a fair trial in at least those areas of the Madras Presidency which compare favourably with Bengal. Finlow's thought-inciting opinion on the possibility of this crop in parts of Madras is quoted below. " Outside Bengal, the climatic conditions in Madras seem to be more favourable than in any other part of India visited by me. The Malabar coast has already been described as having a climate similar in many ways to that of Bengal. The physical features of the district are very different ; but there is no apparent reason why jute should not thrive on a considerable scale in the large area of rice land in Malabar and South-Kanara. In Ganjam, again, the conditions appear fairly favourable. The rain-fall which, while not heavy, is probably sufficient to raise the crop, and it is well distributed ; the soil especially inland is distinctly good; and the district is well supplied with irrigation. The great deltas of the Godavari, Kistna, and Kaveri rivers ....would at first sight appear to be ideal centres for jute cultivation. In practice the difficulty will be probably the question of the time of sowing especially in the low lands."

During the period 1905 to 1909 experiments on the introduction and cultivation of Bengal jutes at the Samalkot and Thaliparamba agricultural stations have been conducted. The initial high hopes that were entertained on the success of these experiments faded away by 1908 and were prematurely discarded for the following apparent reasons :—

1. Insufficient knowledge of the crop and incorrect time of sowing.
2. Difficulty to early preparation of the land and to secure the required tilth.
3. Inadequate manuring.
4. High cost of growing the crop and preparation of the fibre, and
5. want of sufficient skilled labour.

It may be pointed out that the experiments with this crop were rather empirical and for a comparatively short period only. As such significant and valuable results were not obtained which could be used

as the last word on the prospects of development of the Industry in Madras. Such of those difficulties as were experienced during this short lived endeavour should have helped deeper thinking to earnestly devise ways and means to surmount them. Instead disappointment seems to have prevailed. Further it is not improbable that with the change in the outlook of the agricultural department at about this period to improve local crops and to organise separate crop sections with wider scope for expansion and immediate results, the importance of jute and other long fibre crops was not so striking to justify an equal share of attention. Anyhow Finlow's strong opinion expressed to Couchman in 1908 that "the prospects of jute in Madras is decidedly hopeful" still remains unheeded, though it deserves consideration.

An examination of the Season and Crop Reports for Madras from 1902 to 1936 shows only inconsiderable acreages under jute during most years—varying from about 500 to a little more than 2,000 acres distributed in Ganjam, Vizagapatam, Godavari, Guntur and Nellore districts, to mention only the most important ones. In exceptional years, however, the acreage under jute (Corchorus sp.) has been very remarkable as seen from the following figures:—

Period	Total acres for the Presidency	Acres for Vizag, district only.
1919—1920	10,889	10,807
1923—1924	14,358	13,492
1935—1936	25,354	24,425

It is clear therefore that this industry is not altogether unpopular with the ryot. That this crop has a place among the other commonly grown fibre crops of this Presidency, namely Hibiscus, sunn-hemp etc., and also has a decent chance of success in some localised areas are quite evident. Hence it may not be out of place to indicate the necessity for a policy in favour of this crop with a view to exploit the scope of its industry in all its aspects in suitable places of Madras. For this a scheme of experiments, demonstration and propaganda seems highly essential to tap potentialities which may ulitimately bring in a measure of prosperity to the needy and favourably located cultivator and others.

"Men talk as if victory were something fortunate. Work is victory. Wherever work is done, victory is obtained. There is no chance, and no blanks" (Emerson).

References.

Choudhury, N. C. (1908). *Jute in Bengal.*

Dodge, Chas Richards. A descriptive catalogue of useful fibre plants of the world.

Finlow, R. S. (1906). The extension of Jute Cultivation in India. Report published by the *Agri Res. Inst. Pusa.*

Goulding E. (1919). *Cotton and other vegetable fibres.*
Hannan, W. I. (1902). *The Textile fibres of Commerce.*
Mollison J. (1909). Note on the extension of cultivation of Fibre plants in India. *Pusa, Agri. Res. Inst. Bull.* 15.
Murray, Alexander R. (1934). The Jute Industry. *J. Roy. Soc. Arts.* Vol. 82, No. 4263.
Oakley F. I. (1928). *Long vegetable Fibres.*
Royle J. F. (1885). *Fibrous plants of India.*
Watt, G. *Dictionary of Economic Products of India.*
Agriculture and Animal Husbandry in India—1933—34 and 1934—35; Part I. Crop Production, P. 91.
Fibres: A summary of figures of Production and Trade relating to Cotton Wool Silk Hemp Flax Jute. Empire Marketing Board (E. M. B/ c/ 6) July 1933.
Report on the Operations of the Dept. Agri. Madras 1905—09.
Review of the Trade of India in 1935—36. Dept. of Commercial Intelligence and Statistics, India.

EXTRACTS

A Coincidence or What? This year I was asked to remove a growth from the upper eyelid of an Ayrshire cow. The growth, which was the size of a cricket ball, was removed and the surface cauterised and dressed with an ordinary wound lotion; but after a time the growth recurred, and also the lower lid became affected. The cow being very old and nearly due to calve, the owner did not have the growth removed a second time, but said that as soon as she had calved he would have her destroyed. A good heifer calf was born, but here comes the coincidence—the calf had only one eye. There is no doubt but that the growth was malignant. (*The Veterinary Journal*, Vol. 93, No. 9, September 1937.)

A Treatment for Swallowed Needles. A Mastiff puppy, six months ol', when playing with its mistress, was seen to swallow a needle and cotton at 10-30 p. m. The treatment consisted in taking a large handful of cotton wool, teasing it out and mixing with butter into pills the size of a large walnut. The puppy was fed with these and swallowed about sixteen or eighteen of them. This was followed two hours later with two ounces of liquid paraffin. being repeated every two hours, until the bowels acted. At 6 a. m. the next day the puppy had a large evacuation which contained the needle and thread entangled in large ball of the cotton wool. I have also found this very satisfactory for safety-pins and jagged pieces of bone. It is always better to use long-fibre cotton wool. (*The Veterinary Journal*, Vol. 93, No. 9, September 1937.)

ABSTRACTS

Feeding Experiments with Canned Food Packed in Aluminium Containers by Gulbrand Lunde, Valborg Aschehoug, and Hans Kringstad. (*Journal of the Society of Chemical Industry*, September 1937).

When sardines and other foods are canned in aluminium containers, small quantities of the metal will be dissolved by the food during storage. When storage continues over a period of several years, the metal content of the food may rise to about 100 mg. per kg, i. e., not more than may be dissolved by certain foods during domestic cooking in aluminium utensils.

Experiments with mice fed on canned food containing about 0·05 mg. of aluminium per animal per day were carried out during the most rapid period of the growth of the animals; the animals developed normally and showed no abnormal signs to indicate that aluminium in canned food has any injurious effect. No accumulation of aluminium in the animals could be found.

A similar test was made with rats, each animal being fed daily on canned food containing about 0·4 mg. of aluminium. The aluminium consumed by the animals was quantitatively eliminated with the excreta. Growth was normal. In another test rats were fed up to the fifth generation on four year old canned food containing aluminium. No injurious effect was demonstrable. Growth was just as good in the first as in the last generation, and equalled the growth of the control groups fed on ordinary stock diet and on food canned in other material. Determination of the aluminium content of the rats' lungs, heart, spleen, kidneys, liver, and muscle-tissue showed that no accumulation or retention of aluminium had taken place. (Author's abstract).

Gleanings.

Preserving Eggs. A new chemical preserving process, invented by a Chinese scientist in California, is said to prolong the freshness of eggs, possibly for years. The Chinese are known to have a secret process by which eggs retain their edibility for a hundred years, but this is declared to be something different. By the new process, the porous egg shells of natural calcium carbonate are coated with more of the same material thereby excluding all air and moisture, adding strength against breakage in handling and retarding deterioration. (*Industry*, Calcutta, October 1937).

Conditioning of Silk in Bengal. A conditioning house for raw silk, it is understood, is shortly to be established by the Government of Bengal for developing the silk industry of the Province.

The conditioning house which will be perhaps the only one of its kind in India will be equipped with testing and conditioning appliances and will be entrusted with the function of testing the standard of not only raw silk but of silk fabrics as well produced in the country and certifying as to their quality. The fixation of a standard or grade of quality by the house will, it is expected, go a long way in checking frauds and malpractices and inspiring the confidence of the prospective buyers. (*Industry*, Calcutta, October 1937)

Utilisation of molasses. During the past five years, the Biochemistry Department of the Indian Institute of Science, Bangalore, has been engaged on the study of technical problems relating to the utilisation of cane molasses, the chief by-product of modern sugar Industry. A number of interesting results of practical value have been obtained and were recently reported to the Indian Sugar Tariff Board. One of the most important findings is the development of a process for the conversion of molasses into a dry, solid product which will not absorb moisture and can stand transport over long distances.

The product is a good fertiliser and is much more efficient in its action than the original molasses. Its nitrogen fixing capacity is also very high. It can easily be applied to land.

The manufacture of the dry powder is a very simple process. The chemicals required for this purpose are cheap and abundantly vigorous and is accompained by considerable evolution of heat, so that the entire mass boils spontaneously within a few minutes. On cooling the product dries rapidly and can be easily powdered.

It is estimated that the new product will be worth at least Rs. 15 to Rs. 20 per ton as fertiliser (as compared with other known fertilisers on the market). (*Industry*, Calcutta, October 1937.)

Permanganate in Fertilizer. Addition of potassium permanganate in small amounts to fertilizers has been found in England to increase the yield of radishes,

lettuce, and of other vegetables. It also has the effect of removing moss and earth-worms from lawns which suggests its use on the greens of golf courses. Presumably one of the effects of this powerful oxidising agent is to convert organic nitrogen to nitrates in the soil as well as to supply small amounts of manganese sometimes deficient in the soil. D. H. K. (*Scientific American*, October 1937).

Adlay (*Coix Lachryma—Jobi* Linn) is a grain capable of supplementing rice, with the same delectability. It lends itself for the preparation of the various foods just like rice. It is more wholesome than wheat or rice with its greater fat and protein contents.

Adlay is dibbled—2 to 3 seeds in each hole spaced 2 to 2½ feet apart in high lands. The seed rate is 6—10 lbs. per acre. The crop tillers well, covers the ground and is cut when mature, in 4—5 months, and yields 1000 to 1900 Madras Measures of grain an acre. A ratoon crop can be taken, when conditions are favourable. It is remarkably free from diseases, but subject to parrot damage. (*The Tropical Agriculturist*, Vol. LXXXIX, No. 3, September 1937).

Crop and Trade Reports.

Paddy—1937-38—Intermediate Monthly Report. The harvest of first crop paddy has either concluded or is concluding in parts of the Central districts, the South and the West Coast. The yield is expected to be normal in Tanjore and slightly below normal in the other districts. The condition of the standing crop is generally fair.

The wholesale price of paddy per imperial maund of 82$\frac{2}{7}$ lb. as reported from important markets on 8th November 1937 was Rs. 3—0—0 in Madura, Rs. 2—12—0 in Chittoor and Virudhunagar, Rs. 2-10-0 in Vellore and Trichinopoly, Rs. 2-8-0 in Vizianagaram, Kumbakonam and Tinnevelly, Rs. 2—7—0 in Masulipatam, Rs. 2—6—0 in Bezwada and Guntur, Rs. 2—5—0 in Ellore and Hindupur, Rs. 2-4-0 in Cocanada, Rajahmundry, Anantapur and Cuddalore, Rs 2—1—0 in Conjeevaram and Rs. 1—15—0 in Negapatam. When compared with the prices published in the last report, i. e., those which prevailed on 4th October 1937, the prices are stationary in Bezwada, Masulipatam, Guntur, Cuddalore, Vellore and Negapatam, reveal a rise of about 38 per cent. in Chittoor, 14 per cent. in Kumbakonam and Madura, 8 per cent. in Trichinopoly, 7 per cent. in Virudhunagar, 6 per cent. in Hindupur and 5 per cent. in Vizianagaram, and a fall of about 5 per cent. in Tinnevelly and 3 per cent. in Cocanada, Rajahmundry, Ellore and Conjeevaram.

Sugarcane—1937—Intermediate report. The condition of the sugarcane crop is generally satisfactory throughout the province and the yield is expected to be normal if the season continues to be favourable.

The wholesale price of jaggery per imperial maund of 82$\frac{2}{7}$ lb. as reported from important markets on 8th November 1937 was Rs. 5-8-0 in Adoni, Rs. 4-12-0 in Mangalore, Rs. 4—10—0 in Erode, Rs. 4—6—0 in Trichinopoly, Rs. 4—2—0 in Salem, Rs. 3—15—0 in Cuddalore, Rs. 3—14—0 in Coimbatore, Rs. 3—10—0 in Rajahmundry, Rs. 3—7—0 in Chittoor, Rs. 3—5—0 in Vellore, Rs. 3—0—0 in Vizagapatam, Rs. 2—13—0 in Cocanada, Rs. 2—6—0 in Bellary and Rs. 2—5—0 in Vizianagaram. When compared with the prices published in the last report i. e., those which prevailed on 4th October 1937, these prices reveal a rise of 12 per cent. in Chittoor and 4 per cent. in *Vizagapatam and a fall of* 16 per cent. in Vizianagaram, 15 per cent. in Cocanada, 8 per cent. in Rajahmundry, 7 per cent. in Trichinopoly, 6 per cent. in Coimbatore and 3 per cent. in Bellary, the prices remaining stationary in the other centres.

Groundnut—1937—Intermediate Report. The condition of the winter crop of groundnut is satisfactory in East Godavari, West Godavari, Chingleput, Coimbatore, Trichinopoly, Madura, Ramnad, Tinnevelly and Malabar. Elsewhere the crop has been affected by the hairy caterpillar in parts of Bellary, South Arcot, Salem and Tanjore and by drought in the remaining districts.

The wholesale price of groundnut (shelled) per imperial maund of 82$\frac{2}{7}$ lbs. as reported from important markets on 8th November 1937 was Rs. 5—4—0 in Vizagapatam, Rs. 5—0—0 in Cuddalore, Rs. 4—8—0 in Vizianagaram, Rs. 4—5—0 in Erode, Rs. 3—15—0 in Cuddapah and Vellore, Rs. 3—14—0 in Coimbatore, Rs. 3—13—0 in Adoni, Rs. 3—12—0 in Nandyal and Bellary and Rs. 3—11—0 in Hindupur. When compared with the prices published in the last report, i. e., those which prevailed on 4th October 1937, these prices reveal a fall of about 14 per cent. in Vizianagaram, and Nandyal, 13 per cent. in Cuddapah, 10 per cent. in Bellary, 9 per cent. in Cuddalore, 7 per cent. in Erode, 6 per cent. in Vellore, 5 per cent. in Adoni and one per cent. in Vizagapatam.

Gingelly—1937-38—Intermediate monthly report. The gingelly crop has been affected to some extent by drought in parts of Bellary and Anantapur. The yield is expected to be normal outside these districts.

The wholesale price of gingelly per imperial maund of 82$\frac{2}{7}$ lbs. as reported from important markets on 8th November 1937 was Rs. 6—15—0 in Trichinopoly, Rs. 6—8—0 in Cocanada, and Tinnevelly, Rs. 6—7—0 in Cuddalore, Rs. 6—6—0 in Salem, Rs. 6—5—0 in Ellore, Rs. 6—4—0 in Tuticorin, Rs. 5—12—0 in Vizianagaram, Rs. 5—9—0 in Rajahmundry and Rs. 5—8—0 in Vizagapatam. When compared with the prices published in the last report, i. e., those which prevailed on 4th October 1937, these prices reveal a rise of about eleven per cent., in Salem, two per cent. in Vizianagaram and Tinnevelly and one per cent. in Vizagapatam and Tuticorin and a fall of about five per cent. in Rajahmundry and two per cent. in Ellore, the prices remaining stationary in the other centres.

Cotton—1937-38—Intermediate monthly report. In parts of the Central districts and the South the sowings of cotton are still in progress. The area under the crop is expected to be slightly above normal in the districts of Salem and Coimbatore and generally normal in the other districts. The condition of the young crop is generally fair.

In the Deccan, the sowings of *hingari* or late cotton have concluded and are expected to be above normal in the Bellary district where cotton was sown in the place of korra in parts. The yield from *mungari* or early cotton is expected to be generally below normal. The germination of the *hingari* crop is satisfactory.

The local cotton trade is not generally active at this time of the year. The wholesale price of cotton lint per imperial maund of 82$\frac{2}{7}$ lb. as reported from important markets on 8th November 1937 was about Rs. 18—15—0 for Cocanadas, Rs. 13—13—0 for Westerns (*mungari* crop), Rs. 16—4—0 for Westerns (*Jawari* crop), Rs. 22—12—0 for Cambodia, Rs. 25—5—0 for Coimbatore—Karunganni, Rs. 18—14—0 for Tinnevelly—Karunganni, Rs. 17—8—0 for Tinnevellies and Rs. 21—4—0 for Nadam cotton. When compared with the prices published in the last report, i. e., those which prevailed on 4th October 1937, the prices reveal a fall of about 18 per cent. in the case of Westerns (*mungari* crop), 14 per cent. in the case of Westerns (*Jawari* crop), 12 per cent. in the case of Tinnevelly—Karunganni 10 per cent. in the case of Cambodia and Tinnevellies, 6 per cent. in the case of Coimbatore—Karunganni and one per cent. in the case of Nadam, the price of Cocanadas remaining stationary. *(Director of Industries, Madras.)*

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1937 to 12th November 1937 amounted to 490,599 bales of 400 lb. lint as against an estimate of 533,100 bales of the total crop of 1936-37. The receipts in the corresponding period of the previous year were 582,532 bales. 394,431 bales mainly of pressed cotton were received at spinning mills and 200,620 bales were exported by sea while 95,885 bales were imported by sea mainly from Karachi and Bombay.

(*Director of Agriculture, Madras*).

Association of Economic Biologists, Coimbatore.

Two meetings of the Association were held on 25th October 1937 and 15th November 1937 respectively. The following papers were presented at the meetings:—

Coconut Breeding. *By Dr. J. S. Patel, M. Sc., Ph. D.* At the Agricultural Research Station, Kasaragod, it is found that on an average of 12 years, 13 per cent of the trees yielded 21 per cent of the total crop and 7 per cent of the trees produced only 2 per cent. The characteristics of these 13 per cent. eco-types of the palms are: (1) presence of relatively a larger number of leaves in the crown, which is not so much due to the higher production of leaves as the greater longevity of the leaf, (2) reduction in response to cultural, manurial and seasonal conditions.

Apart from the variations in the yield of nuts, these eco-types vary in the production of female flowers, the setting, the size of the nut and the thickness of the meat. In order to determine whether this variation is inherited, and to what extent it is possible to combine these characters, crosses have been made between the eco-types exhibiting these characters. Suitable selfed and naturally pollinated material forms the control.

About 30 per cent. of the population is not regular in the production of nuts. Crosses have also been made between regular and irregular bearers.

It is well known that the dwarf type of the palm commences to yield earlier than the ordinary tall type. The dwarf type and the tall eco-types have been crossed.

It was found that a larger proportion of crossed nuts germinated earlier than the selfed and naturally pollinated nuts, and among the crosses those with the dwarf male as one of the parents germinated most rapidly.

On the whole it is found that variability with regard to the characters like the period for emergence of successive leaves, and the height and the girth of the seedling, are more in the F_1s than in the selfed first generation. Of the progeny of the twenty tall type of parents, tree No. I/121 and II/107 are superior in respect of the above mentioned three characters and also in respect of early separation of leaflets. It appears that the progenies of parents producing a very large number of female flowers are better than the progenies of trees yielding exceptionally well. The development of the F_1s of dwarf × tall crosses is outstanding.

Studies on the White Moth Borer of Sugarcane in S. India. *By M. C. Cherian, B. A. B Sc., D. I. C. and C. K. Subramanian.* The White moth borer (*Scirpophaga*) is reported from different countries such as Congo, Shanghai, Formosa, Borneo, Java, Ceylon, Burma, India etc. It has been studied to some extent in North India while information on this pest under South Indian conditions is rather scanty. The results of the studies of this borer have shown that, though not a major pest as *Diatraea sticticraspis*, it is not so unimportant as once considered.

Life history. The moths are sluggish creatures and do not live for more than 3 to 4 days. Under Coimbatore conditions the pest takes 54—74 days to complete its life cycle; the egg, larval and pupal (including prepupal) periods being 6—10, 34—42 and 14—22 days respectively.

Symptoms of damage. The symptoms of damage are many of which the mining of the mid-ribs, cross-holes on the leaves, dead-hearts of various sizes, peculiar exit holes for the emergence of moths and bunchy top of the mature canes are the more important.

Extent of damage. Regarding the extent of damage, it may be stated that the pest attacks both young shoots as well as mature and immature canes. Though not a major pest as *D. sticticraspis* this borer also is capable of inflicting some injury to the cane. Counts of infestation in a few fields in Coimbatore are given. The pest has been noted from many districts of this presidency.

Species of Scirpophaga in S. India. Previous workers have stated that there are two species of *Scirpophaga*, viz. *S. monostigma* (black spotted) and *S. auriflua* (without spots). The authors have shown that both the spotless and the spotted forms are derived from the progeny of either. Detailed studies of the genitalia of the moths are in progress.

Natural enemies. Considerable progress has been made in the study of the natural enemies of the pest. In addition to the egg parasite, *Telemous* sp. seven larval parasites have been collected and valuable information gathered on four of these.

Remedial measures. Handpicking of adult moths, collection of eggmasses, removal of affected plants, etc., are suggested. The egg parasite of *Diatraea* moths, *Trichogramma minutum*, does not appear to parasitise *Scirpophaga* egg-masses in nature. Earthing up of cane shoots said to be successful in Mysore is being tried in the Central Farm.

The Colour of Black Soils—the Influence of Organic Matter. *By P. Venkataramiah and C. Raghavendrachar.* Various hypotheses have been put forward to explain the dark colour of black soils, i. e., (i) presence of large quantities of organic matter, (ii) their being derived from dark coloured rocks, the basalts, (iii) presence of titaniferous magnetite in the sandy fraction, (iv) the presence of an iron-organic colloidal matter; but none of these have successfully explained the dark colour. The authors in a previous paper have shown that the black soils have a high SiO_2/R_2O_3 molar ratio and Ca and Mg in the silicate complex of the clay fraction which prevents the oxidation of iron; while in the red soils with a low molar ratio of SiO_2/R_2O_3 and a low Ca and Mg content, the iron is capable of being oxidised to give the red colour, though both types of soils have about the same iron content.

Examining a number of black soil profiles, it was noticed that they had a zone of black soil at the top and a light coloured zone in the lower depths and while the silica sesquioxide molar ratio and the Ca and Mg contents of both zones were about equal, the organic matter content (estimated by digesting soil with 5% NaOH) of the upper dark layers was higher than that of the lower layers. When treated with H_2O_2, the dark colour of the upper zone did not disappear, while when the soil was treated with N/5 HCl, and washed free from chlorides, and then treated with H_2O_2, the dark colour of the upper zone disappeared and the soil assumed the same light colour as that of the lower zone. During the oxidation the CO_2 evolved was estimated by absorption in soda lime.

In a laterite profile (Taliparamba, North Malabar,) similar differences in depth of colour of the upper and lower zones were observed, and similar treatment with H_2O_2, resulted in discharge of the colour of the upper zone soil. The

upper zone of a laterite profile had an organic matter content 2·5 times that of an upper black soil zone.

The dark colour of two surface soils of black soil is thus probably due to the association of organic matter with a clay having a high SiO_2/R_2O_3 ratio and a Ca and Mg silicate complex which gives a darker colour to an already grey soil and in the case of the laterite soil the presence of organic matter gives a darker shade to a red soil.

Absorption of soil moisture during germination of cotton seed. *By T. V. Rangaswami, B. Sc., Ag.* Germination plays an important role in economic crop production. Quantity of soil moisture present at the time of and subsequent to sowing is one of the chief causes that affect germination. The control of moisture during germination is of paramount importance in cotton. "This done, out-of-season growth also may prove successful within certain limits."

The present note deals with absorption of soil moisture during germination by different varieties of cotton seeds. It was found that the rate of absorption depends upon the moisture saturation in the soil and also on the nature of the seed (whether acid treated or normal). Varietal variations were also noticed. In the absorption, two phases, viz. a mechanical or prewelling process followed by physiological absorption were observed. Invariably a 'lull period' existed between the two phases of absorption. The growth of the radicle was closely associated with higher absorption of moisture. Response to this metabolic activity was greater under lower saturations than under higher saturations. In some cases higher saturations of moisture were found to be not utilized and in others they were even harmful for normal activity. Incidently it was also demonstrated that water enters the embryo through the seed coat besides through the micropyle during germination.

College News and Notes.

Students' Club. "Students should take an active part in politics" was the subject of an interesting debate which took place on 11—11—'37 with the Principal in the chair. Messrs. K. Mahabala Shetty and V. Srinivasan were the mover and the opposer respectively. After a discussion in which many students took part the motion was put to vote and carried by a majority.

Cricket. The students of the Agricultural College had a fixture with the officers on 31—10—'37. Contrary to the popular expectation, the students gained a smashing victory. The officers put on a modest total of 117 runs, the principal contributor being C. Ramaswami (75). Dinker Rao and Kothandaraman on the students' side captured 4 wickets each for the loss of 20 and 28 runs respectively. The students replied with 159 for 5, Kothandaraman having retired with his 60 and Mukundan remaining unbeaten with his 55.

The Inter-collegiate tournament began well with the Agricultural College meeting the local—Government College on the 13th November, ending in brilliant victory for the former. The Agricultural College batted first and declared at 202 for the loss of 8 wickets. K. K. R. Menon was brilliant with his 45 closely followed by Kothandaraman with his 37. Rama Iyengar was unbeaten with his 35 runs. P. S. Srinivasan claimed 5 wickets for 68 runs. The Government College was then dismissed for a paltry 72 runs, the distinguishing batsman being K. Subramaniyam who scored 38 runs. Dinker Rao was very successful with the ball, taking 5 wickets at the cost of 20 runs. Kothandaraman followed him by claiming 4 wickets for 27 runs.

14—11—37 saw a brighter cricket. The Trichy Railway Institute played with the Agricultural College. The vistors, batting first, sent up 155 on the board for all out. Sundaram Chetty was the hero of the day with his bat and he was unbeaten with his polished 52 runs. He exhibited some powerful and fine strokes. The other principal scorers were George (27) and Timmins (26). Timmins began well and hit up an excellent, straight six but he was unfortunately dismissed soon. The bowling credit goes to Dinker Rao who broke down 4 wickets for 45. The Agricultural College, batting next, declared at 158 for 3. Shiva Rao played a steady game and quickly scored 69 runs. Next to him came C. N. Babu and Kothandaraman with 43 and 16 respectively. As C. Ramaswami was run out very early, the visitors were deprived of a chance of seeing the test player's polished and brilliant batting.

Hockey. In the semi-final round of the Coimbatore Hockey Tournament, played on 27—10—37 on the Forest College Grounds, the Stanes High School defeated the Agricultural College by 1 goal to nil after an exciting contest.

Both the sides put up a strong fight. The winners combined well and scored their only goal just five minutes before the full time. The college players put up a good defence. K. K. R. Menon, the college goalie, saved a number of goals and but for him, the college would have fared worse.

The Victoria College, Palghat, played with the Agricultural College on the 7th inst. in connection with the Inter-collegiate tournament. The latter won the match by 6 goals to 1.

Having come out victoriously in the first match of the Inter-collegiate tournament the Agricultural College met the local Government College on the 15th instant. The match ended in a draw.

Visitors. The Honourable V. I. Munuswami Pillai, Minister for Agriculture and Development, visited the Central Farm, the College Dairy and some sections of the Agricultural Research Institute on the 30th of last month, along with Mr. N. S. Varadachari, Parliamentary Secretary.

Mr. N. S. Apte, Director of Agriculture, Gwalior, visited the Institute on 22—10—'37.

Mr. A. G. Beattie, Senior Agricultural Officer, Nigeria, arrived here on the 16th from Hosur. He visited the various Breeding Stations and the Research Institute during his stay here of about a week.

Academic Council. For one vacancy in the Council, consequent on the resignation of Mr. K. Raghavachari, Mr. H. Shiva Rao was elected.

M. Sc. Degree. We are glad to note that Mr. P. Abraham of the Cotton Section has been awarded the M. Sc. degree of the Madras University for his thesis on "*Studies on the anatomy of the cotton flower*".

RETIREMENT

Rao Bahadur N. S. Kulandaiswami Pillai, another "Saidapet Veteran" retired from service on the 9th of the month. Joining service as some of his predecessors had done in the Revenue Department he was like them deputed for training in the Saidapet Agricultural College. He served in the subordinate cadre as Farm Manager at Koilpatti and as a district work officer in the sixth circle till 1918 when he was promoted to the gazetted rank. He was confirmed as Dy. Director in 1931. Except for two breaks, one in connection with an enquiry

into the marketing possibilities of Tanjore rice in Ceylon and the other for the period he was acting as the Head quarters Dy. Director at Madras the whole of Mr. Pillai's service was spent in the V circle which comprises the districts of Trichinopoly and Tanjore, and the many improvements now in evidence in the agricultural practices of these two districts owe not a little to the indefatigable and persistant efforts and organising capacity of Mr. Pillai. In recognition of his good services the Government honoured him with the title of Rao Saheb in 1933 and that of Rao Bahadur recently. We wish him a long and happy retired life.

OBITUARY

It is with deep regret that we have to announce the death of B. Dasappa Malli on the 13th November at Coonoor where he was working as Agricultural Demonstrator.

Young in years and full of promise as a very capable propaganda officer it was a shock to us to hear of his untimely demise. We offer our sincere condolences to his relatives in their bereavement.

Weather Review—OCTOBER 1937.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	7·1	−0·9	41·4
	Calingapatam	8·2	+0·2	29·7
	Vizagapatam	9·2	+2·1	28·9
	Anakapalli*	8·8	+1·1	40·0
	Samalkota*	8·4	−0·8	35·9
	Maruteru*	10·4	+2·8	33·8
	Cocanada	10·3	+2·4	40·2
	Masulipatam	10·0	+1·9	33·7
	Guntur*	9·8	+4·1	32·3
Ceded Dists.	Kurnool	4·4	+0·9	22·1
	Nandyal*	3·7	+0·5	28·4
	Hagari*	2·4	−1·1	15·7
	Bellary	4·0	+0·1	15·0
	Anantapur	11·2	+7·5	30·9
	Rentachintala	...	...	...
	Cuddapah	7·0	+2·0	21·3
Carnatic	Anantharajupet*	11·6	+9·7	29·5
	Nellore	11·1	+2·7	48·5
	Madras	10·4	−1·3	29·5
	Palur*	8·4	−2·0	21·3
	Tindivanam*	11·9	+2·7	28·7
	Cuddalore	11·7	+0·7	22·8
Central	Vellore	8·9	+2·6	33·3
	Salem	4·7	−2·0	24·4
	Hosur*	3·3	+0·7	25·7
	Coimbatore	5·1	−1·3	17·7
	Coimbatore A. C. & R. I.*	3·5	−2·2	15·9
	Trichinopoly	7·5	+0·6	32·8

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	11·6	+1·1	26·0
	Aduthurai*	8·6	+0·8	22·1
	Madura	1·6	−6·2	14·9
	Pamban	9·8	+0·8	25·3
	Koilpatti*	4·2	+8·1	15·6
	Palamkottah	7·8	+1·0	16·3
West Coast	Trivandrum	12·8	+2·2	52·5
	Cochin	16·2	+3·0	118·6
	Calicut	11·2	+1·0	121·7
	Pattambi*	17·4	+5·2	86·7
	Taliparamba*	...	...	...
	Kasargode*	13·8	+3·0	167·3
	Nileshwar*	9·3	0·0	150·1
	Mangalore	9·3	−1·8	141·5
Mysore and Coorg	Chitaldrug	2·3	−1·9	17·4
	Bangalore	3·7	−2·2	29·2
	Mysore	11·5	+5·2	37·9
	Mercara	8·4	0·0	115·7
Hills	Kodaikanal	12·9	−3·2	54·5
	Coonoor	11·0	...	46·9
	Ootacamund*	8·4	+1·9	48·5
	Nanjanad*	7·9	+0·5	43·9

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in Fort St. George Gazette.

The Bay depression which formed in the Southwest Bay of Bengal off Cuddalore, after moving westwards merged into the unsettled conditions off Malabar Kanara Coast, caused a cyclonic storm in the Arabian Sea centred near latitude 16°N, longitude 71°E on 4th. The storm later moved as a low pressure wave and induced a shallow depression over the North Deccan and got filled up on 7th near Pendra. On 12th, a trough of low pressure extended over the Bay of Bengal from off the Coromandel Coast to off the Arakan Coast, enclosing a small depression at each end of trough. The two depressions within the trough later coalesced together and developed into a cyclonic storm on 13th, which moved in the North-Easterly direction, causing widespread heavy rain in Bengal and Assam.

Thundery weather prevailed in the second and fourth week in certain portions of the Bay of Bengal and in parts of the Arabian Sea and the Andaman Sea.

The setting of the North-East Monsoon was recorded at the end of the third week. But the monsoon became fairly active in the South-West Bay and the

South of the Peninsula and caused fairly wide-spread rain in the southern half of the Peninsula, on 30th and 31st.

Thunder showers were very common throughout the Peninsula, during the last three weeks of the month and had, scattered and widespread thundershowers, in Malabar, Kanara, Mysore, and Madras.

Rainfall was generally in excess all over the Presidency and most markedly so in the Deccan Districts.

Chief falls reported were :—

Negapatam	4·4″	on 31st.
Cuddalore	5·8″	,, 1st.
Kodaikanal	3·5″	,, ,,
Pamban	3·8″	,, ,,
Trivandrum	4·8″	,, ,,
Maruteru	3·9″	
Anantharajupet	3·8″	
Tindivanam	6·6″	
Kasargode	4·3″	
Ootacamund	4·0″	

Special Reports of Heavy Rainfall.

Vanoor	7·6″	On 1st October.
Panruti	6·3″	
Villupuram	5·7″	
Tindivanam	5·0″	
Ulundurpet	5·0″	

Weather Report for the Research Institute Observatory :

Report No. 10/37.

Absolute maximum in shade	91°F
Absolute minimum in shade	65°F
Mean maximum in shade	86·9°F
Departure from normal	-0·9°F
Mean minimum in shade	70·6°F
Departure from normal	+0·4°F
Total rainfall	3·47″
Departure from normal	-2·28″
Heaviest fall in 24 hours	1·05″ recorded on 28th.
Total No of rainy days	8 days.
Mean daily wind velocity	1·0 M. P. H.
Mean Humidity at 8 hours	77·4%
Departure from normal	-1·5%

Summary. The mean maximum and minimum were almost normal. The mean Humidity was in defect by 1·5%. Rains occurred mostly during the first and fourth weeks of this month and the heaviest fall of 1·05″ was recorded on 28th. Rainfall was in large defect.

P. V. R. & P. G.

Departmental Notifications.

Transfers.

Name of officer.	From	To
Mr. B. P. Papayya	A. A. D. Tadepalligudem	A. A. D. Chintalapudi (New Sub-circle).
" T. S. Dakshinamurthi	A. D. Guntakal	A. D. Adoni.
" C. Annamalai	A. D. Palmanier	F. M. Kalahasti.
" K. B. Vydeswara Iyer	F. M. Kalahasti	A. D. Chengam.
" N. V. Kalyanasundaram	A. D. Chengam	A. D. Palmanier.
" M. Ratnavelu	A. D. Gingee	A. D. Tiruchengode.
" K. M. Venkatachalam Pillai	A. D. Tiruchengode	A. D. Gingee.
" T. Natarajan	F. M. A. R. S. Samalkota	Asst. L. A. Coimbatore.
" M. C. Menon	F. M. Taliparamba	A. D. Calicut.
" M. P. Sankaran Nambiar	A. D. Calicut	A. D. Tellicherry.
" P. A. Narayana Nambiar	A. D. on leave	A. R. S. Taliparamba.
" K. Krishnamurthi	F. M. Anakapalli	A. D. Parvatipur.
" K. Suryanarayana	A. A. D. Parvatipur	A. A. D. Salur (New Sub-circle).
" V. Suryanarayana	Asst. L. A. Coimbatore	A. D. Tadepalligudem.
" T. G. Anantarama Iyer	F. M. Hosur	C. F. Coimbatore.
" M. K. Swaminatha Iyer	F. M. C. F. Coimbatore	VI circle, Madura.

Leave.

Name of officer.	Period of leave.
Mr. V. Suryanarayana, A. L. A. Coimbatore	L. a. p. for 1 month from 23—10—37.
" K. Sivasankara Menon, A. D. Perintalmanna	" for 1 month from 3—11—37.
" K. S. Ramanna Rai, A. D. Mudabidri	" for 2 months from 12—10—37.
" M. C. Krishnaswami Sarma, A. D. Dindigul	" for 2 months from 5—11—37.
" K. P. Anantanarayanan, Asst., Entomology-section	" for 1 month from 3—11—37.
" T. K. Mukundan, A. D. Wallajah	" for 2 months from 20—11—37.
" C. S. Krishnaswami, Asst., Mycology section	Extension of l. a. p. for one month & 13 days from 11—11—37.
" D. Panakala Rao, A. D. Nandigama	L. a. p. for 1 month and 2 days from 22—11—37.
" P. S. Narayanaswami, Physiological Scheme, Cotton section	L. a. p. for 1 month from 8—11—37.
" M. Ratnavelu, A. A. D. Gingee	Extension of l. a. p. on m. c. for 2 months from 9—10—37.

ADDITIONS TO THE LIBRARY, OCTOBER 1937.

A. Books.

1. *California Soils.* Weir, W. W. & Storie, R. C. (1936). 2. *Land Value Rating.* Douglas, F. C. R. (1936). 3. *Farm Tenancy in the United States, 1918—1936—A List of Selected References.* Bercaw, L. O. O. (1937). 4. *The Coconut Industry of the Philippine Islands.* Cooke, F. C. (1936). 5. *Leguminous Forage Plants.* Robinson, D. H. (1937). 6. *Chrysanthemums.* Taylor, H. V. (1936). 7. *Domestic Preservation of Fruits & Vegetables.* Adams, Miss. M. L. (1937). 8. *Pyrethrum Flowers.* Gnadinger, C. B. (1936). 9. *The Mathematical Problem of the Price Index.* Montgomery, J. K. (1937). 10. *Outlines of Marketing.* Agnew, H. S., etc. (1936). 11. *A Book on Joshi's Modern Designs--Dwellings.* Joshi, K. C. (1937). 12. *The Farmer and His Debt.* Qureshi, A. I. (1934). 13. *Better Villages.* Brayne, F. L. (1937). 14. *Animal Breeding Plans.* Lush, J. (1937). 15. *Nervous Systems of the Ox (Anatomical Study).* Chelva Ayyangar, H. W. (1937). 16. *The Design and Analysis of Factorial Experimets.* Yates, F. (1937).

B. Reports.

1. Indore Institute of Plant Industry Progress Report for 1937. 2. Report on Demonstration Work carried out in the Western Circle of the Agricultural Department, Central Provinces and Berar, 1936. 3. Report on Demonstration Work carried out in the Eastern Circle of the Agricultural Department, Central Provinces and Berar, 1936. 4. Annual Report of the Royal Botanic Garden and the Gardens in Calcutta and of the Lloyd Botanic Garden, Darjeeling for 1936-'37. 5. 16th Empire Cotton Growing Corporation Annual Report, 1937. 6. Administration Report of the Acting Director of Agriculture, Colombo for 1935. 7. Malaya Agricultural Department Annual Report for 1936. 8. S. S. & F. M. S. Agricultural Department—Reports of the Field Branch for 1936. 9. Annual Report of the Agricultural Department, Uganda Protectorate, Part (I), 1936. 10. Kenya Colony and Protectorate Agricultural Department Annual Report, 1936. 11. British Guiana Administration Report of the Director of Agriculture for 1936. 12. Zanzibar Protectorate Agricultural Department Annual Report, 1936. 13. Trinidad and Tobago Administration Report of the Director of Agriculture. 1936. 14. Annual Report of the Director of Agriculture, New Hampshire, Agricultural Experiment Station for 1936. 15. 49th Annual Report of the South Carolina Experiment Station of Clemson Agricultural College for 1936. 16. Windsor Tobacco Sub-station Report for 1936.

C. Special Publications.

17. Report on the Preliminary Conference on the Better Utilisation of Forest Areas for Grazing. 18. Notes on Indian Tobacco (Supplement to Indian Trade Journal). 19. Report on the Punjab Erosion Committee, 1932. 20. India in 1934—1935. 21. Karachi Cotton Annual, 1935—1936. 22. Report on the Food Investigation Board for the year 1936 (England). 23. Proceedings of the 13th Annual Convention of the National Fertiliser Association for 1937. 24. 10th Annual Report of the New York State Association of Dairy and Milk Inspectors, 1936. 25. Fifth Annual Year Book of the Iowa Poultry Improvement Association, 1937.

D. Bulletins, Memoirs, Etc.

26. Factors affecting Spray Success in the control of Coffee Leaf Disease, *Mys. Agr. Exp. Stn. Bull. 15, 1937.* 27. Supply and Distribution of the Various Types of Indian Cotton during the season of 1935-36. *ICCC. Stat. Bull. 6, 1937.*

28. Co-operative Village Banks. *Reserve Bank of India, Agr. Credit Dep. Bull. 2.* 29. Soil Erosion; and 30. The Cultivation of Fruits in Ceylon, with Cultural Details. *Cey. Agr. Dep. Bull. 89 and 90.* 31. Antiseptic and other Treatments in the Storage of Trinidad Citrus Fruits with an Appendix on Mycological Notes on Citrus Wastage; and 32. Storage Investigations with Trinidad Citrus Fruits, 1935—1936. *Trinidad Low Temp. Res Stn. Mem. No. 5 and 6.* 33. The Variability of Plant Density in Fields of Wheat and its Effect on yield. *Austr. Comm. C. S. & I. R. Bull. 109.* 34. Cotton Variety Tests of 1934 and 1935; 35. Effect of Seed Treatments on Seedling Emergence, Severity of Seedling Blight and Yield of Rice; 36. Fertilizer Experiments with Cotton in Type-of-Farming Areas; 37. Growth and Fruiting Responses to Pruning and Defloration of Tomato Plants; and 38. A Study of Factors concerned with Rice Growth. *Arkansas A. E. S. Bull. 344; 345; 346; 347 and 349.* 39. Some Moisture Relations of the Soils from the Erosion Experiment Stns. *U. S. Agr. Dep. Tech. Bull. 562.* 40. Annotated List of the Insects and Mites associated with Stored Grain and Cereal Products, and of their Anthropod Parasites and Predators. *U. S. Misc. Pubn. 258.* 41. Soil and Water Conservation in the Pacific North-west. *U. S. Farm Bull. 1773.* 42. Marketing Policies of the California Walnut Growers' Association. *U. S. Farm Credit Admn. Bull. 10.* 43. Transportation of Milk in the Philadelphia Milkshed. *U. S. Farm Credit Admn. Bull. 13.* 44. Scientific Irrigation Management. *Hawaii A. E. S. Bull. 52.*

E. Circulars, Leaflets Etc.

45. Brief Instructions for the Guidance of Lay Persons regarding Improvement of Animal Industry, Chiefly Cattle Sheep and Poultry; and 46. Some Do's and Don'ts in Regard to Poultry and Sheep Breeding. *Mys. Agr. Dep. Cir. 56 & 58.* 47. Traps for the Black Beetle Pest of Coconut Palms; 48. Paddy Cultivation (How to obtain a Higher Yield); 49. Useful Live Fence-posts for Coconut Areas; 50. The Oil Treatment for Killing Diseased Plantain Plants; 51. The Planting of Young Trees; 52. Soil Erosion—General Considerations; 53. Pseudo Fowl Pest; 54. The Coffee Berry-borer; 55. Pink Disease, A Common Disease of Fruit Trees; 56. Pine Apple Cultivation; 56(a). Breeding Places of the Black Beetle of Coconuts; and 57. The Principles underlying Spraying for the Control of Plant Diseases. *Cey. Agr. Dep. Leaf. 92, 93, 94, 95. 96, 100, 101, 103, 104, 107, 108 and 116.* 58. Fowl Pest; 59. The Potato Root Eelworm; and 60. The Chrysanthemum Midge. *Eng. Min. Agr. & Fish. Adv. Leaf. 281. 284 and 286.* 61. Sea Island Cotton Culture. *Geor. Agr. Exten. Ser. Cir. 268.* 62. Tree Root Systems. *N. Dak. Exten. Ser. Cir. 152.* 63. The Relation of Rainfall to the Development of Late Blight of Irish Potatoes in the Coastal Section of South Carolina. *S. Carolin A. E. S. Cir. 57.* 64. Tobacco Shrinkages and Losses in Weight in Handling and Storage; and 65. Artificial Drying of Forage Crops. *U. S. Agr. Dep. Cir. 435 and 443.* 66. Production of Egg Plant. *U. S. Leaf. 131.*

Rural Reconstruction Overseers.

Extract from G. O. No. MS. 1221 dated 1st June 1937—Development Department.

Sub :—District Economic Councils—Establishment—Overseers—Appointment of—Certain districts—sanctioned.

In order to help District Economic Councils in carrying out their programme of rural reconstruction, the Government are pleased to sanction the appointment under the President of the District Economic Council of a Rural Reconstruction Overseer for a period of one year from the date of employment on a pay of Rs. 50—4/2—90 per mensem in the following districts:—

1. Nellore,
2. Cuddapah,
3. South Arcot,
4. North Arcot,
5. South Kanara,
6. Chittoor,
7. Kurnool,
8. Madura,
9. Kistna,
10. Malabar and
11. Ramnad.

The Overseers will be appointed either by direct recruitment or by transfer as and when required by the President, who will be the appointing authority. No consultation with the Madras Public Service Commission will be necessary. The candidates should possess the qualifications prescribed for candidates for selection for appointment as Minor Irrigation Overseer, P. W. D. Overseer or Agricultural Demonstrator. No age limit will be prescribed. The President should arrange to give the selected candidate a course of training in rural reconstruction work and also in elementary town planning as applied to villages. During the period of training a direct recruit will be paid Rs. 35 per mensem only.

2. The Overseers will draw travelling allowance under the Madras Travelling Allowance Rules. The pay and allowance of these officers will be debited to "47. Miscellaneous Departments—g. Bureau of Commercial Intelligence including Statistics—B. District Economic Councils—Establishment—Voted."

3. Necessary special rules including these posts in the Madras General Subordinate Service will be issued in the Public Department. This order should not be given effect to before the issue of these rules.

"True Extract"

Institute of Plant Industry, Indore. C. I.

Research Studentships. Two research studentships in Genetics and Plant Breeding carrying an honorarium of Rs. 50 per mensem in the first year are offered at the above institute by the Indian Central Cotton Committee. Candidates should possess an M. Sc. degree or honours B. Sc. degree in Botany. B. Sc. (Agriculture) and B. Ag's will also be considered but *all* applicants must produce evidence of special training in Genetics and Plant Breeding or Experimental Statistics. Forms of application and particulars of the conditions of tenure may be obtained from the *Director, Institute of Plant Industry, Indore.* Applications should reach Indore not later than December 31st, 1937. The successful candidates will be required to take up their studentships on April 1st. 1938.

(Sd.) T. R. Low,
Director,
Institute of Plant Industry.

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Report on the Development of the Cattle and Dairy Industries of India.

By N. C. WRIGHT, M. A., D. Sc., Ph. D.

(*Summary of Principal Conclusions and Recommendations.*)

CHAPTER I

The total output of milk in India is exceptionally large, being between 700 and 800 million maunds or 5,600 and 6,400 million gallons per year. Compared with other countries India stands second in volume of milk production. She produces over four times the output of Great Britain, over five times that of Denmark, over six times that of Australia and over seven times that of New Zealand.

Owing to the density of India's human population the per capita consumption of milk is, however, extremely low. Estimates indicate that the average consumption per head per day does not exceed 7 to 8 oz.

According to existing dietary standards the quantity of milk required for the maintenance of satisfactory growth and health lies between 15 and 30 oz. per head daily. The output of milk in India would, therefore, need to be at least doubled in order to meet even the minimum requirement.

The consumption of milk is shown to vary according to income level. If consumption is to be increased it is essential that the price of milk should be within the purchasing power of the majority of the population. It is therefore not only necessary to increase the existing output of milk, but to effect all possible economies in the costs of production and distribution of milk and the manufacture of milk products.

CHAPTER II

In planning the development of the dairy industry it is essential to ensure that it caters for the existing taste and dietary habits of the population. Marketing surveys show that of the total output of milk, roughly one third is consumed as liquid milk. Of the remainder over 76 per cent. is converted into *ghee* and over 22 per cent. into *khoa*, *dahi* and other indigenous products. Western products such as creamery

butter and cheese are scarcely used except by Europeans and a small number of Indians who have acquired a taste for them.

The relative unimportance of Western products is also apparent from an examination of the quantity of milk products imported into India. These represent less than half of 1 per cent. of the total value of the milk products produced in India. An increase in the value of ghee by only 1 per cent. would add more to the wealth of the dairy industry than the replacement of the whole of the imported milk products by Indian produced articles.

There is little doubt that the evolution of the indigenous milk products which are peculiar to India (i. e., *ghee*, *khoa*, *dahi*, and related products) has been largely due to the fundamental difficulties involved in handling milk under tropical conditions and to the special problems associated with the lack of adequate communications and transport facilities.

The fact that 90 per cent. of the population live in rural areas introduces a further obstacle to the introduction of Western methods into Indian dairying practice. In particular it appears that the wide-spread adoption of a large-scale factory system of dairying in India would involve almost insuperable difficulties.

These facts indicate that what is needed in Indian dairying is a new out-look and a new technique; an out-look which recognises the special nature of India's problems and a technique which is designed to solve these problems.

Among the more important considerations which should be taken into account in the formulation of such a technique the following may be mentioned: first, the attention should be concentrated on the production of indigenous milk products and not on products of Western origin; second, steps should be taken to ensure that an adequate supply of milk and/or milk products is available for consumption by the rural population; third, any attempt to introduce improved methods should be effected by evolutionary rather than revolutionary changes of technique; fourth, the combination of producers on a village industry basis (as distinct from a factory basis) should prove the most effective form of dairy organisation in India; and fifth, any improvements in production should be supplemented by the provision of improved marketing facilities.

CHAPTER III.

Consideration of the methods of producing and distributing milk for liquid consumption should not be limited to the supply of milk to large urban centres, which include only some three per cent. of the population. Nevertheless, in view of the abnormally low milk consumption in large cities and of certain special difficulties involved in the provision of adequate supplies of milk in such densely populated

areas, a separate section of the present Report has been devoted to problems connected with city milk supplies.

As regards the general problems of milk production and distribution, these are partly associated with the lack of knowledge of hygienic methods of handling milk, and partly with the difficulties inherent in the tropical nature of the climate, the poverty of the Indian cultivator, and the lack of adequate communications and transport facilites.

On account of these special difficulties the methods of producing and handling milk in India may have to be greatly modified from those employed in temperate zones. Extensive investigations will require to be carried out on this subject. Such investigations should not be limited to laboratory studies, but should be tried out in practice under village conditions.

Some form of heat treatment will probably prove the best and most economical method of prolonging the keeping quality of milk under tropical conditions. Such treatment should be applied as soon as possible after production. Refrigeration also offers great scope for development in relation to the transport of milk to large cities, but the costs involved are considerable and will need to be greately reduced if the method is to be capable of widespread adoption.

The distribution of milk not only introduces the risk of re-contamination but offers unlimited opportunity of adulteration. As regards recontamination, it is extremely doubtful whether the introduction of modern Western methods, such as pasteurisation and bottling, could ever be employed on any considerable scale in India. For the mass of the popoulation some form of 'loose' milk distribution is inevitable. It is suggested that cheap methods of 'loose' milk delivery, such as. those largely employed in rural areas in Great Britain should be investigated under Indian conditions, and if necessary, modified to suit local needs.

As regards adulteration, figures collected from provinces show that from 20 to 65 per cent. of samples are watered or other-wise adulterated. Assuming that milk is, on the average, adulterated to the extent of 10 per cent. of added water, the financial loss to the dairy industry amounts to over 10 crores of rupees. Legislation exists for checking adulteration, but this is not applied effectively.

A second essential in checking adulteration is the formulation of reliable methods of analysis and satisfactory standards of purity. As regards methods of analysis, it is recommended that standardised apparatus should be employed and that revised conversion tables should be worked out. As regards standards of purity, extensive investigation is still required to enable the fairness of existing standards to be assessed. It is also suggested that the feasibility of allowing the 'standardisation' or 'toning' of milk should be considered.

CHAPTER IV.

There is no doubt that the production of *ghee* must be looked upon as the most important single factor in any scheme of development of the dairy industry. This product is of special value in Indian dairying economy, since it not only provides the cultivator with a cash sale, but leaves with him the greater and more valuable part of the milk, *i. e*, the non-fatty solids contained in the *lassi* or butter-milk. This also applies to the production of 'country' butter.

The first direction in which improvement might be effected in the production of *ghee* is in the total outturn. But it is equally essential that quality should not be sacrificed in efforts to obtain higher yields of *ghee*. The whole subject of the relationship of out-turn to quality of *ghee* requires thorough investigation.

Figures collected from provinces show that up to 65 per cent. of the samples of *ghee* which were examined were adultered. A calculation of the total quantities of adulterants available in India indicates that these amount to at least 6 per cent. of the total output of *ghee*. It is found, however, that there is a difference of opinion among authorities regarding the analytical standards for the detection of adulteration. These require re-investigation. In addition it is most desirable that a cheaper and quicker method for detecting adulteration should be devised.

It is suggested that the difficulties involved in the sale of *banaspatine* under the term (vegetable) *ghee* could be met by the adoption of legislation similar to that which governs the sale of margarine in Great Britain.

It is urgently necessary that facilities should be provided for the improved marketing of *ghee*. Additional markets should be established in those *ghee* producing areas which are not at present adequately provided for. In addition, an attempt should be made to establish grading centres, preferably under the Agricultural Produce (Grading and Markeing) Act, 1937. The value of advertisement as a means of popularising improved grades of *ghee* should be explored.

'Creamery' butter constitutes only about 0·15 per cent. of the total output of milk products in India. There are, however, indications that the demand for such butter is increasing and the needs of this branch of the dairy industry should not therefore be neglected. The most important direction in which improvement should be sought is in the quality (flavour and texture) of the product.

CHAPTER V.

Apart from liquid milk and *ghee* the most important dairy products produced in India are *khoa*, *dahi* and certain other indigenous milk products. The quantity of milk utilised in their manufacture approximates 95 milllion maunds (760 million gallons), which is more

than twice that utilised for the whole of the production of manufactured milk products in Great Britain. It is also significant to find that the indigenous Indian milk products realise more per maund of milk than liquid milk itself. This is contrary to the experience of practically all Western countries, but re-emphasises the importance of these products to the Indian dariy industry.

Certain of these products are manufactured by a process of partial desiccation, while others are produced by the souring of the milk. The processes of manufacture are however primitive and crude, and urgently call for improvement. Attention should be given to better methods of packing and marketing and to the provision of standards of quality. It is also suggested that the munufacture of indigenous milk products might provide a useful outlet for separated milk, where this is available.

It is desirable that the nutritive value of the various indigenous milk products should be carefully investigated in view of their widespread consumption.

The production of cheese in India is negligible, and imports of cheese are equivalent to only 0·002 per cent. of India's total milk production. Nevertheless the manufacture of European varieties of cheese (to replace imports) might be encouraged at hill stations.

CHAPTER VI

The amount of separated milk produced in India is small and little if any of it is wasted. A considerable quantity is, however, made into casein, and this is lost as a source of nutriment. The question arises to whether it would be justifiable to attempt to establish milk condensing and drying factories.

The present market for condensed milk in India is relatively small. There is a considerable market in South and East Africa, in Malaya, and in other Far Eastern countries but the possibility of building up an export trade from India is open to considerable doubt. Very little milk powder is consumed in India, but there is some indication that the market for this product might be expanded. Consideration of a number of relevant factors indicates that the feasibility of establishing condensing and drying factories in India would depend largely on whether the requisite quantities of milk could be collected at convenient centres, and whether such milk would be of sufficiently good quality to be capable of conversion into condensed milk and milk powder.

CHAPTER VII

India possesses the largest number of cattle of any country in the world. Out of the world's cattle population of about 690 million animals, 215 million (or just under one third) are located in India. Owing to adverse climatic and economic conditions the productive

value of the cattle industry is not commensurate with its size. Nevertheless the actual and potential value of cattle products is very great.

Milk and milk products may be valued at about 300 crores of rupees. This is roughly equivalent to the value of India's total output of rice, and is three to four times the value of the output of wheat. India is also the largest exporter of hides and skins in the British Empire, her yearly output of this group of products being valued at roughly 40 crores of rupees, or more than the value of the total Indian production of sugar. Cattle labour also represents an important contribution of live-stock to Indian agriculture, the monetary value calculated on the basis of cultivation costs being estimated at between 300 and 500 crores of rupees.

The value of cattle as a means of raising the fertility of the soil cannot be readily computed. One estimate places the cash value of cattle manure at 270 crores of rupees. There is no doubt that the widespread adoption of 'composting' would greatly enhance the value of this manure. But the potential value of cattle as a means of introducing a 'mixed-farming' system in India, and thus of improving crop yields, is incalculable. In any such system of 'mixed-farming' the introduction of leguminous fodder crops would still further increase soil fertility, while the improvement in crop yields should off-set any apparent increase in the cost of milk production.

CHAPTER VIII

Comparatively slow progress is being made in the distribution of pedigree and approved bulls; the number of bulls at present at stud represents only one per cent. of India's requirement. There is little doubt that material progress will only be achieved by increasing the number of approved and registered stock raised in villages and by private breeders. The purchase of such bulls for distribution provides a most valuable stimulus to improved cattle breeding in selected areas and gives encouragement to progressive breeders. At the same time it is essential that 'type' should be preserved within each breed and this will necessitate the continued maintenance of Government breeding farms where the methods of breeding can be more accurately controlled.

It is difficult to assess the value of the present castration policy in eliminating the scrub bull. Progress in the number of castrations performed varies from province to province. There is still considerable difficulty in getting young stock castrated at a sufficiently early age. One direction in which future action should be concentrated is the intensification of castration measures in selected breeding areas, combined, if possible, with the inoculation of all local stock against rinderpest.

CHAPTER IX

There is probably no single measure which would do more towards increasing and cheapening milk production in India than an improvement in the milk yields of Indian cattle. At present the yields of village cattle average only about 600 lb. per year. An increase in yield would lower the cost of milk production by spreading maintenance costs and costs of depreciation and labour over a larger output of milk.

In formulating breeding policies two essentials must be kept in mind: first, the necessity for adopting a policy which will meet local requirements; and second, the need for continuity in the programme of breeding and the urgency of ensuring that the programme is not prematurely interrupted.

Certain breeders have tended to rely on cross-breeding with sires of high-yielding European breeds to raise the productivity of their stock. The immediate beneficial results of such cross-breeding on milk yield are striking, but they have invariably been obtained in herds where exceptional facilities for the control of breeding, as well as of feeding and general management, have been available. In the hands of *gowalas* and similar uneducated owners of milking stock the results have frequently been disastrous. There is no doubt that the general adoption of a policy of cross-breeding to improve the milk yields of country stock would be fatal to the development of sound dairying in India.

Breeding experiments carried out at various centres show that by careful selection indigenous strains of Indian cattle can be built up which are capable of giving milk yields comparable with those found among average European stock. It is essential that the breeding of high yielding strains should be greatly extended. In order to encourage such breeding the establishment of herd-books and of a system of milk record should be proceeded with as soon as possible.

There is no doubt that she-buffaloes must be looked upon as the premier milk-producing stock in India. Their growing popularity is reflected in the census statistics, while marketing surveys indicate that they already provide nearly half of India's total milk supply.

With intensive milk production there is inevitably a constant rivalry between constitution and economic performance. Management is therefore an extremely important factor, particularly under the exacting conditions of climate experienced in the Indian plains. The relation of management to the maintenance of a sound constitution should be looked upon as one of the major subjects for investigation in connection with the breeding of improved stock.

CHAPTER X

The majority of Indian milch cattle are seriously underfed. This is apparent not only from a superficial inspection of stock, but from

the slow rate of growth, the late maturity and the long dry periods of cattle kept under village conditions.

Estimates of the total quantities of nutrients available for the feeding of cattle in India show a marked deficiency especially in the amount of protein. If milk production is to be increased the provision of a very much larger food supply is essential.

Coarse fodders are relatively valueless for milk production. Cultivated grasses are reasonably satisfactory, but the fodders of outstanding value are the leguminous crops such as berseem (Egyptian clover) and lucerne (alfalfa). It has already been noted that these are of special importance to Indian agriculture by virtue of their ability to enhance the fertility of the soil. Wide variations in the yields and costs of production of these fodder crops have, however, been recorded. Careful and extensive investigations into the factors responsible for these variations are urgently needed. Such investigations should include a study of the effect of the leguminous crops on the subsequent growth of cash and food crops. They should also include a study of the value of different fodders in the feeding of milking stock and on the costs of milk production. The conservation of such fodder crops also requires investigation.

Efforts should be made to increase the available supply of protein-rich concentrates such as linseed, cotton-seed and earth-nut cakes. This might be achieved by encouraging the export of vegetable oils and by improving the efficiency of the mills.

It appears to be a fairly universal experience that Western rationing systems are not suitable for application to Indian cattle and buffaloes. It is therefore desirable that a suitable system of rationing should be devised for the guidance of milch cattle owners. In addition it will be necessary to obtain representative analytical figures of typical feeding stuffs for as many agricultural areas as possible.

During the past few years instances of mineral and vitamin deficiency diseases have been recorded in India. There is little doubt that such deficiencies are far more common than has been generally supposed, and that they are a source of serious economic loss. It is desirable that extensive surveys of the incidence of such deficiency diseases should be undertaken, and that the information so obtained should be supplemented by accurate studies of mineral requirements and by mineral analyses of fodders drawn from typical cattle breed- and milk producing areas.

CHAPTER XI

In order to provide an adequately staffed and equipped centre for research into the many problems which face the dairy industry, it is recommended that the existing Imperial Dairy Institute should be transferred to a more suitable site and should be reconstituted as an

Imperial Dairy Research Institute. Under the Director the work of the Institute would be divided into four sections, namely, dairy bacteriology, dairy chemistry, dairy technology and dairy husbandry. Details are given regarding the buildings, equipment and staff required for such an institute.

If such an institute is established, the need for a separate experimental creamery (such as that proposed at Anand) will not arise. The Anand Creamery would, however, provide an ideal substation for the study of problems involved in the supply of milk to large cities, should such a substation ultimately be required. It is suggested that the whole of the Anand Creamery proposals should be held over meantime until the new Research Institute has been established and preliminary experiments have been carried out on the various problems involved in dealing with liquid milk.

Side by side with the development of the new Research Institute, efforts should be made to encourage the investigation of dairying problems at provincial agricultural colleges. The Imperial Council of Agricultural Research might give valuable assistance in this direction.

The course for the Indian Dairy Diploma provides a valuable basis of instruction for students who desire general training in dairying. The proposal to extend the period of instruction from two to three years is shown to be unnecessary though certain alterations in the syllabus are desirable. In particular, more stress should be laid on the methods of production of indigenous milk products, on the need for devising cheap types of equipment, and on improvement in the methods of producing milk and milk products by co-operative enterprise and by the development of village industries. The course should also include practical training in methods of imparting instruction.

Training for the I. D. D. should be given at provincial agricultural colleges and not at the central institute. It is doubtful, however, whether such training could at present be satisfactorily arranged in all provinces. It is therefore suggested that the number of centres should meantime be limited. The transfer of instruction would necessitate the provision of certain safeguards, including the adoption of a uniform syllabus and of a reasonable degree of uniformity in the methods of instruction at all centres and the establishment of a central examining board. The appointment of a special committee under the Imperial Council of Agricultural Research is recommended.

As regards post graduate training, the course for the National Diploma in Dairying of Great Britain is entirely unsuitable for Indian students. For graduates who require training in technical dairying, the I. D. D. course provides adequate instruction. For graduates who require training in research methods facilities should be provided at the Imperial Dairy Research Institute. Opportunity should also be taken to encourage such graduates to gain further experience by

studying at recognised research laboratories abroad. For this purpose scholarships might be provided by the Imperial Council of Agricultural Research.

If improved methods for the production and handling of milk and the manufacture of milk products are to be made use of in the villages, it will be essential to have available a large number of workers trained in certain elementary dairying practices. Courses of training for such workers should be provided at provincial agricultural colleges. It is recommended that serious consideration be given to the provision of dairy training for women.

It is desirable that dairying instruction at veterinary colleges should be extended to include a knowledge of elementary dairying and of the principles involved in the production and handling of milk including the management of a dairy herd.

It is strongly recommended that provincial governments should take the necessary steps to establish an advisory service for the dairy industry. As a first step it is suggested that a Dairy Development Officer should be appointed in each province. The major duty of such an officer would be to initiate dairying developments and to take the lead in encouraging the adoption of improved methods. The Dairy Development Officer should work under a special committee representative of the various branches of government activity concerned.

In order to secure co-ordination between the central and provincial governments, it is recommended that the Director of the Imperial Dairy Research Institute should act as part-time Dairy Expert to the Imperial Council of Agricultural Research, and that in this capacity he should be responsible for maintaining contact with provincial dairy developments. He should be provided with a special officer who could relieve him of much of the detailed work involved and who could act as personal liaison officer between the centre and the provinces.

CHAPTER XII

The solution of problems connected with the breeding of cattle requires the appointment of an animal geneticist. Work in this field would include the investigation of problems of inheritance, of problems involving a study of the physiology of reproduction (including endocrinology), and of problems connected with management and constitution. In the investigation of problems of inheritance full use should be made of records available at the various Government breeding farms.

Greater use should be made of existing experimental and demonstration farms (of which there are some 200 in India) in studying problems of fodder production. Such farms should be equipped with small herds of pedigree milch cattle. They could thus fulfil a dual function by acting as centres for the study of mixed-farming methods

and by providing valuable nuclei for the breeding and distribution of pedigree milking stock.

In devising a rationing system suitable for Indian cattle and buffaloes, full use should be made of existing provincial research centres (i. e., Lyallpur, Dacca and Coimbatore) as well as of the newly established Animal Nutrition section of the Imperial Veterinary Research Institute at Izatnagar. A provisional allocation of work is suggested in the Report. The Imperial Agricultural Research Institute at New Delhi should undertake such comprehensive fodder and feeding stuffs analyses as are required.

As regards mineral and vitamin deficiency diseases, the Disease Investigation Officers who have been appointed in each province through the Imperial Council of Agricultural Research should be responsible for field surveys, while facilities should be provided at the Nutrition Section at Izatnagar for the mineral analyses of suspected pastures.

Adequate facilities for instruction in breeding and live stock management are available at most provincial Agricultural colleges. At veterinary colleges, however, facilities for practical instruction are lacking. It is recommended that, as a minimum, each veterinary college should possess a small herd of milking cows, with accompanying bulls and young stock, and sufficient land to demonstrate agricultural operations and to produce fodder for the herd.

There is urgent need for securing suitable men who can be specially trained in cattle breeding and management. The potentialities of a student for live stock work will usually become apparent during his college course, and every effort should be made to pick out such a man for further training. This training should include experience on an approved cattle breeding farm and an advanced course in animal husbandry at a central institution.

In connection with the ultimate establishment of a Genetics Section at Izatnagar a small number of trained geneticists will be required. It is suggested that the Imperial Council of Agricultural Research should consider awarding one or two special scholarships to enable promising post-graduates to obtain the necessary research training overseas.

The effective dissemination of knowledge acquired at research centres, as well as the control of breeding and live stock improvement, will ultimately depend on the employment of a large staff of trained men who can work among cultivators in the villages. For such 'stockmen' it is desirable that special elementary courses of instruction should be instituted.

It is strongly recommended that, in the interests of both efficiency and economy, live stock improvement and veterinary work should be

unified under a single department of animal husbandry. It is recognised that for local and personal reasons immediate unification may not be desirable or possible in all provinces. But it is suggested that unification should be looked upon as the ultimate goal.

If unification is adopted, it will be essential for the Director of the unified department to have on his staff a Live Stock Expert with special knowledge and experience of cattle breeding. It will also be essential to ensure close co-operation with the Department of Agriculture. This would be facilitated by the appointment of a Fodder Specialist, who would normally work in close touch with the Live Stock Expert.

Further cattle improvement cannot be effected without increased expenditure, whether the control of such improvement is under the agricultural department or is unified with the veterinary department. Existing figures show clearly that the extent of live stock improvement in the different provinces runs roughly parallel with expenditure. The unification of animal husbandry and veterinary work should not therefore be looked upon as a means of reducing expenditure on cattle improvement : rather, is it a means of making the best use of any funds available for live stock improvement and of ensuring that such improvement is effected under the most favourable conditions.

The present measures which are designed to improve the general standard of Indian cattle are largely concerned with draught breeds. Every effort should be made to augment the number of agencies which can be used for developing the milking potentialities of indigenous Indian breeds of cattle. Such agencies should include the Military Dairy Farms, district and demonstration farms, and *gowshalas* and *pinjrapoles.* It is suggested that a special officer should be appointed under the Imperial Council of Agricultural Research whose duties would include the stimulation of interest in milch cattle breeding at various centres and the giving of expert advice to *gowshalas* and *pinjrapoles* which desire to improve their methods of management and to adopt a constructive breeding policy.

In order to maintain close cooperation between all departments concerned with rural development, it is suggested that a Board of Rural Development should be constituted in each province. This Board would include the Directors of the Departments of Agriculture, Forestry, Veterinary services and Public Health, a representative of the Irrigation and Revenue Departments and the Registrar of Co-operative Societies. Specialist officers would attend the meetings of the Board. The Chairman would be a non-technical officer of the rank of Commissioner and with a special knowledge of and interest in rural conditions. The Board would act solely as a co-ordinating and advisory body, but would be in a position to make direct representations to the responsible minister in regard to any controversial matters.

STUDIES IN SUGARCANE JAGGERY

III. The Empirical Test for the End-point of Boiling in Jaggery Manufacture.

By T. Varahalu, B. A., M. Sc.,

Agricultural Research Institute, Coimbatore.

The test usually applied to mark the end-point of boiling in the manufacture of jaggery consists in subjecting, from time to time towards the last stages in the process, small portions of the boiling mass to sudden cooling by pouring them into large bulk of cold water. At the stage when this supercooled portion assumes a sufficient degree of hardness as judged by the sound produced when struck against the sides of the pan, the boiling is stopped, the pan removed from the furnace and the mass allowed to cool until signs of the crystallisation of sucrose, or in other words, of the setting of jaggery, become visible. It is then gathered into a heap and transferred into moulds.

The cane juice contains a large bulk of water with sucrose, reducing sugars, non-sugar-organic matter and minerals, free and in organic combination, dissolved, or suspended in it in various states of aggregation. As the boiling progresses, the syrup formed thickens in consistency. *When the 'rab' stage, familiar in sugar manufacture,* is attained, the mass consists of a supersaturated solution of sucrose. If in this condition, it is slowly cooled, sucrose crystals separate out from the mother liquor and the latter becomes to that extent less supersaturated.

But instead of cooling at this stage, in jaggery manufacture it is subjected to further continuous heating. Due to this cause, the solvent action of the mother liquor tends to increase, while at the same time, its quantity gets diminished, due to the rapid evaporation of water from the open pan. Thus, the two processes taking place simultaneously operate in a manner mutually antagonistic with respect to quantities of sucrose held in solution.

As however the liquor gets diminished more rapidly under the open pan conditions, it would be expected that more sucrose would be thrown out than is held in solution.

Now, every external influence upon a mobile system produces a change in such a direction that the resistance of the system towards the external influence is increased as a result of this change. As such, it should be that the sucrose theoretically thrown out of solution is continually changing its phase into a fused or molten form, consequent on the absorption of heat. Thus, it can be easily visualised that a stage would be reached *in the boiling of the* juice to jaggery, when the

whole mass would consist of molten or fused sucrose with the impurities embedded in it, taking even the residual water only as an impurity. Therefore the answering of the empirical test seems only to mark the stage when this phase transformation is accomplished.

From this it follows that the conditions for the setting of jaggery, or the crystallistion of sucrose from the final mass, in the normal method of manufacture of jaggery, can be taken to be similar to those governing the crystallisation of any substance from its melt, i. e. to the conditions of the tranformation of liquid (melt) to solid (crystal) when the liquid phase alone is present to start with.

It is well known that the following are among the most important of the factors for the good crystallisation of any substance from its melt :—

(i) The specific crystalline capacity of the substance.

(ii) The molecules of the substance should posses high specific velocities for free and rapid movement.

(iii) The resistance to the velocity of the spontaneous nuclei formation should be a minimum.

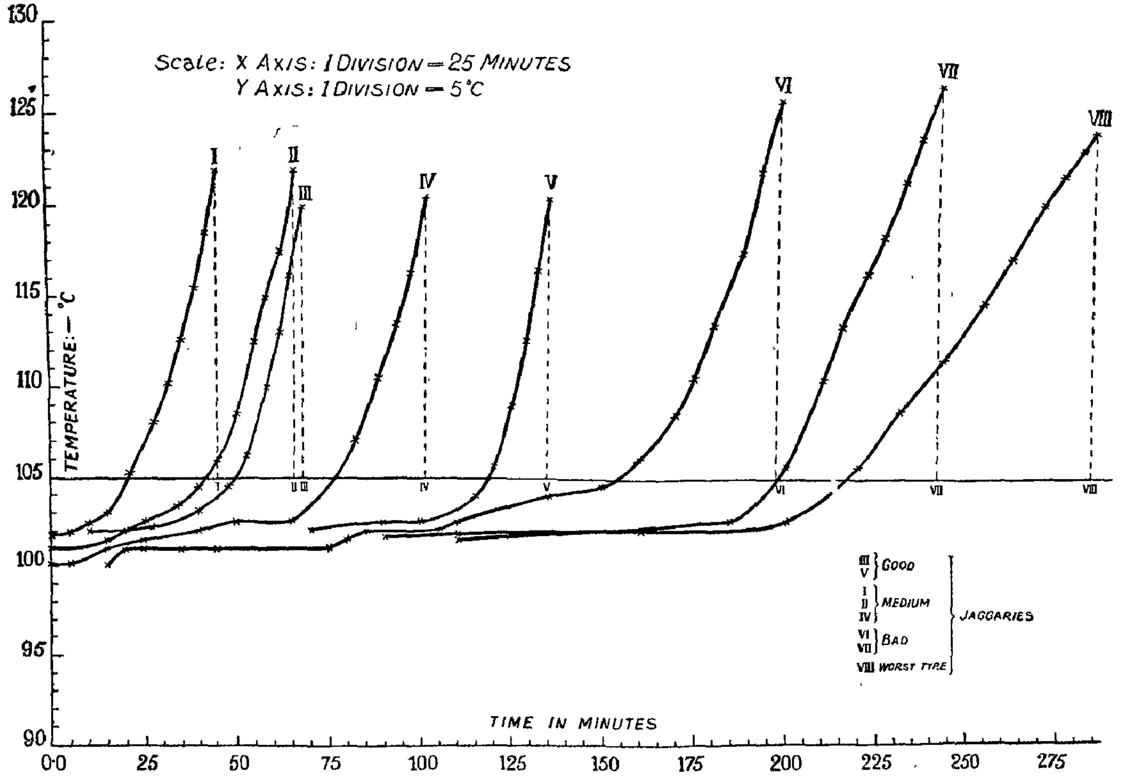
(iv) The system should allow of free translational movements of the molecules of the crystallising substance.

(v) The distances over which the molecules have to travel, before finding nuclei to deposit themselves on, should be short, or in other words, the thickness of the adsorbing layers should be as small as possible.

These conditions may now be applied to the crystallisation of sucrose in the setting of jaggery. The conditions (i) and (ii) are constant for purposes of the present study as the substance concerned is a chemical unit, sucrose, but the only factor on which these depend is that of temperature. But so far as the factor (ii) is concerned, it is also a function of the molecular weight of the substance, and in the case of sucrose, this is as high as 342, and is inherently comparatively sluggish in its movements. Any system in which it is present in high concentration presents conditions of viscosities of high magnitudes. Further, sucrose has very high solvating capacities. Factors (iii) and (iv) are mainly concerned with the proportion and the properties of impurities accompanying sucrose, and with the temperature of the system, and factor (v) is almost exclusively determined by the proportions of the non-sucrose materials or the impurities.

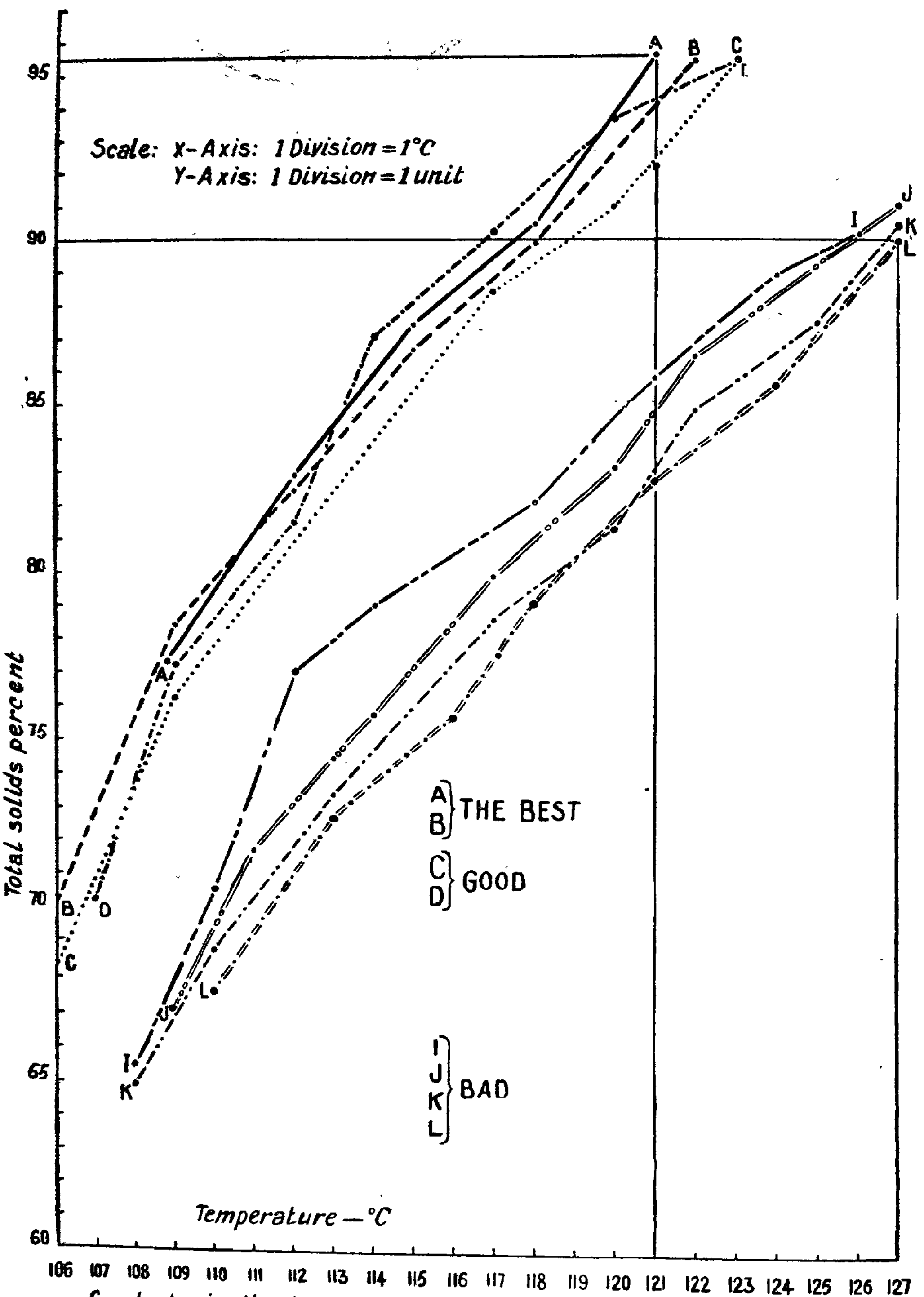
The rate at which nuclei form is a fundamental factor on which the rate of crystallisation depends. But the mere existence of the nuclei need not necessarily lead to the formation of crystals. The crystal formation and their growth is considerably influenced by the stage in the period of cooling at which the nuclei form. If the nuclei form at a high speed immediately below the melting point, they grow

T. VARAHALU



GRAPH SHOWING THE MANNER OF TEMPERATURE RISE WITH TIME TOWARDS THE FINAL STAGES IN THE PREPARATION OF JAGGARY

PLATE I



Graph showing the changes in concentration & the corresponding temperatures during the boiling down of the cane juice to Jaggary.

PLATE II

quickly into visible crystals. This is what happens in the cases where good jaggeries are produced. An examination of the data in Tables 1 and 2 reveals that the setting of the masses where good jaggeries were formed took place in shorter times and at higher temperatures. But if the nuclei form at a slow rate and gradually increase on cooling, the velocity of their formation is affected to a high degree by secondary influences as (a) the presence of impurities, and (b) the viscosity of the medium, and so, on all factors on which the latter depends. Under such conditions, it is possible that the nuclei may only tend to remain latent without showing any signs of growing into visible dimensions. The several gradations which this suggests in the matter of the setting of the jaggery and the formation of the crystals and their growth, are illustrated by the data pertaining to the bad jaggeries presented in Tables 1 and 2. In all cases where bad jaggeries are produced, the time taken for setting was long, and temperature at which it took place was low.

On the concentration of the impurities and their capacities to adsorb on the already heavy molecules of sucrose depends the thickness of the adsorbing layer. This thickness of the adsorbing layer controls both the rate of the translatory motion of the molecules and also the distances over which they have to travel to find nucleus to deposit themselves on. The medium should be less dense, less viscous and be at a higher temperature to admit of free movement of molecules. Otherwise even if the nuclei form in large numbers, the crystal growth will be greatly impeded. The falling temperatures accentuate the adverse effects both of viscosity, and of the impurities.

That the impurities which accompany sucrose in the good and the bad jaggeries are so distinctly different, and cause strikingly contrasting effects in the process of jaggery manufacture is illustrated by the differences in the slopes and the forms of the curves for the two types of jaggeries in Plates I and II. It can be easily seen that the bad jaggeries contain substances which cause high viscosities, retard the progress of boiling, cause a tenacious retention of moisture, and offer resistance to the formation of the nuclei and the growth of the sucrose crystals. Such adverse effects are not present in good jaggeries. In the latter cases the boiling was taking place smoothly and quickly and the crystallisation proceded rapidly and unimpeded.

Another interesting point that becomes evident from the data in Tables 1 and 2 is that excepting in very abnormal cases, in all the rest the empirical test was answered almost normally, irrespective of the fact whether there were produced good or bad jaggeries eventually from these masses. This invariable tendency to answer the empirical test on the part of the final masses in all cases at once suggests that they all tend to approach one common physical condition, namely that

of molten or fused sucrose with all the impurities, including the residual water, embedded in it, and that the answering of the test only marks the completion of this approach.

Thus, the answering of the empirical test does not seem to convey, as such, any more meaning beyond indicating the completion of the transformation. The test does not by itself ordinarily throw any light on the probable behaviour of the final mass after answering the test, whether it would eventually yield a good or a bad jaggery. This test also does not appear to have any relationship to the quality of the juice started with. The final strikes obtained from rich good juices, as also those resulting from the use of juices which are poor, usually answer the test almost alike.

But it must be here noted that as the degree of abnormality of the juice increases, due to whatever cause, the approach to the common physical condition is either imperfect, or delayed or not approached at all, depending upon the particular conditions.

In the light of these considerations, it will be seen that so far as the physical conditions of the jaggeries are concerned, they may be considered in three distinct stages:

(i) The condition when the final concentrate answered the empirical test.

(ii) The condition when the setting of the jaggery or the crystallisation of sucrose takes place, and

(iii) The condition of the jaggery in the final form.

In stage (i) it may be considered as a mass of molten or fused sucrose with the impurities embedded in it, the molten sucrose forming the continuous phase.

In stage (ii) when crystallisation takes place during cooling, there will result a contraction of the mass in the mould, and a discontinuity in the outer phase of the fused sucrose due to crystal formation. The consequence of this would be that a sort of syneresis occurs and the previously protected syrupy fluid exudes out.

Now, if the crystallisation takes place in shorter time and at higher temperature, the crystals would grow well and the largest portion of the enclosed fluid would exude out. Due to the high temperatures prevailing, the liquid will be thin and highly mobile. In this state, and assisted by the high stresses which also prevail concomitantly, it is easily driven from the centre to the periphery in the mould, and gets compressed into thin envelope on the outside, the sucrose crystals forming a hard highly crystalline inner core. This is what happens in all good jaggeries, as will be seen in a subsequent communication.

But if the fluid is viscous and slow drying, and further, if its proportion is also high, the portions of it that first leak out, when the

discontinuity in the sucrose phase occurs consequent on nuclei formation, quickly surround and enmesh each particle, and prevent the rapid diffusion of the sucrose molecules towards the nuclei. This diffusion is further retarded with fall in temperature. Thus the crystals do not grow well and the fluid remains distributed over the entire bulk of the jaggery, without being driven far towards the periphery. These conditions obtain in varying degrees in bad jaggeries.

In stage (iii) when jaggeries have set and cooled down and as they are available for direct consumption, they may be considered as consisting of the matrix material mixed with solid crystals of sucrose of different sizes. The differences in the hardness, strength, consistency and in structures noticeable so commonly among jaggeries, are evidently intimately associated with the drying capacity of the matrix, and the number of crystals of different sizes, and the proportions which they bear to each other and to the total matrix.

Again, with lapse of time, diffusion through the matrix takes place extremely slowly, such that with ageing, crystal growth and fresh crystal formation are frequently observed to take place.

The author takes this opporunity to express his grateful thanks to Rao Bahadur B. Viswanath, Director, Imperial Agricultural Research Institute, New Delhi and to Mr. P. V. Ramiah, the Government Agricultural Chemist, Coimbatore, for the facilities and encouragement they afforded.

Table 1.

Showing the Times and the Temperatures of the Setting of Jaggery.

Variety.	Temp. at the end of boiling. -°C.	Time taken for the setting of jaggery minutes.	The temp. at which the setting took place. -°C.
		Good Jaggeries.	
P. O. J. 2878	123	9	109
Co. 213	122	9	104
,,	120	7	110
Co. 313	123	8	109
B 208	119	6	108
Co. 281	121	11	105
Co. 281	121	13	106
M. A 21	122	10	105
Co. 243	119	10	104
		Bad Jaggeries.	
Co. 313	123	18	95
D. 131	124	18	93
Co. 213	123	24	95
Co. 213	121	22	93
J. 247	120	27	89
Co. 313	121	20	91
E. K. 2.	122	25	86
Purpule Mauritius	123	18	92
P. O. J. 2878	120	17	95
Co. 243	122	80	64
Co. 213	123	60	70

Table 1 (continued).

These two were not fully ripe and they were grown in dry lands. There was profuse frothing and fuming. The empirical test was not answered satisfactorily. The mass did not actually set; it only congealed on cooling. It was tough, stringy and glassy.

J. 247	124	95	60

The mass did not set but only congealed into a glassy material. The canes consisted of superfluous sets which remained over for some days during hot weather. The final mass in this case did not answer the empirical test at all. The chilled mass always remained soft. It could not be even gathered well into the hand. The mass did not show signs of crystallising even after one year as judged by the naked eye.

Table 2.

Statement Showing the Manner of Temperature Rise Towards the Final Stages in the Boiling Down of the Cane Juice to Jaggery.

Sample Number. I.		II.		III.		IV.	
Time in Min.	Temp. -°C.	Time in Min.	Temp. -°C.	Time in Min.	Temp. -°C.	Time in Min.	Temp. -°C.
	102		101		102		100·1
5	102	15	101·5	10	102	5	100·1
10	102·5	20	102	27	102·2	15	101
15	103	25	102·5	40	103·2	25	101·5
21	105·2	35	103·5	48	104·5	40	102
28	108			53	106·2	50	102·5
32	110·2	40	104·5	58	110	65	102·5
35	112·5	45	106	62	113	76	104·8
39	115·5	50	108·5	64	116·2	82	107
42	118·5	55	112·5	68	120	88	110·5
45	122	58	115			93	113·5
		62	117·5			97	116·3
		66	122			101	120·6
						103	124·5

Sample Number. V.		VI.		VII.		VIII.	
70	102		100	110	101·5	90	101·5
90	102·5	20	101	180	102·5	110	101·5
100	102·5	75	101	200	105·6	160	102·1
110	104	80	101·5	210	110·5	200	102·5
120	105·5	85	102	215	113·5	220	105·6
125	109	105	102	222	116·5	231	108·8
129	112·6	110	102·5	227	118·5	243	111·6
132	116·5	135	104	232	121·5	254	114·8
135	120·5	150	104·5	236	124·0	262	117·4
				242	127·0	270	120·4
		160	106			276	122·0
		170	108·5	Fuming and Frothing The test is however answered.		281	123·4
		175	110·5			284	124·4
		180	113·5			Fuming and Frothing. The test is not answered well. The chilled mass was always soft.	
		188	117·5				
		193	122				
		197	126				

Approximate Time (Min.) taken for the Completion of the Boiling from the Time when about 105°C is Reached.

Sample No.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
*Time in Min.	25	24	18	27	17	43	45	67

* These times are as measured from the graph. (Plate II).

SOME OF MY REMINISCENCES

BY RAO BAHADUR M. R. RAMASWAMI SIVAN, B.A., Dip. Agri.

I. The Madras Agricultural Students' Union.

It was nearly 50 years ago,—to be more exact, in August 1889—that I got admission as a student in the College of Agriculture at Saidapet, and, after several years' work as Clerk, Farm Bailiff and Lecturer in that institutution, I had the privilege of being one of the staff to be drafted into the Agricultural College and Research Institute at Coimbatore as Chief Assistant to the Government Agricultural Chemist in 1908 and retired, in May 1927, after nearly 20 years, as Government Lecturing Chemist and as Principal. Starting from the lowest rung of the ladder as Second Clerk and Assistant Farm Bailiff on Rs. 20 at Saidapet, it was my good fortune to be promoted to the Indian Agricultural Service and to reach the top of the ladder as permanent Principal of the Institution at Coimbatore, before I retired from service and to watch and often take part in, all the stages of development and vicissitudes, through which Agricultural Education and Agricultural Research had to pass during the last half a century; and I thought it desirable that I should give expression to some of my impressions and experiences while these are still fresh in my mind, with a view to creating some interest in the young men of to-day, towards the old order of things.

In writing these reminiscences, I do not propose to write a connected history of the Saidapet College or the Coimbatore institution, as I think that such an account has already been compiled or can be easily gathered from past Official Records and Annual Reports and may also probably be boring to the reader. What I propose to do is, to take up a particular subject, irrespective of chronological order, and say whatever may appeal to me as interesting with regard to that particular subject and, wherever possible, offer suggestions for further improvements in that particular direction.

There are three subjects with regard to the Agricultural College at Coimbatore with which I have been intimately connected from their inception, namely, *the Madras Agricultural Students' Union, the Agricultural College Officers' Club and University representation*; and these will be dealt separately.

The Madras Agricultural Students' Union: When the Madras College of Agriculture at Saidapet was ordered to be closed and the Agricultural College and Research Institute was started at Coimbatore, some of the *alumni* of the Saidapet College who were posted to work at Coimbatore realised that the institution at Coimbatore was but a continuation of the older one, with the advantage that

Coimbatore possessed a greater variety of soils and crops than Saidapet, admitting of different aspects of farming, and also provided special facilities for Research which did not exist at Saidapet. There was a desire amongst some of us that the contact between Saidapet and Coimbatore should be firm and enduring, and the Madras Agricultural Students' Union was born in one of the hostel rooms, myself having been the Hostel Warden at the time. The late Mr. S. L. D'Silva was our Guru and Chief Adviser and was our first Vice-president, the Principal of the College being always ex-officio President. Messrs. J. Chelvaranga Raju, T. V. Rajagopalachari, and K. Krishnamurthy Rao were some of the first members of the Committee. I had the honour of being elected the first General Secretary and Editor of the M. A. S. U. Journal and I had the good fortune of having Mr. K. T. Alwa as my student associate. We had a lot of controversy at the time about the naming of the new organisation; and we decided that it should be designated "the Madras Agricultural Students' Union" for a number of reasons. It was called the Madras Union because it had to include the old students of the Saidapet College and the old and new students of Coimbatore and also those residing all over the Presidency. It was called the Students' Union because it was to be an organisation between the old students of Saidapet and the old and present students of Coimbatore. The Union was formed in the year 1909 with the following objects:

(a) To encourage an *esprit de corps* among its members;

(b) To protect and promote the interests of its members;

(c) To act as an employment bureau for members;

(d) To exchange opinions and experiences in matters agricultural and make a record of the same;

(e) And to disseminate knowledge in agriculture.

Membership was open to the past students of Saidapet and the past and present students of Coimbatore and to officers of the Agricultural Department, whether they were old students or not. In the earlier years, on the plea that the Union was an Old Boys' Association, some of the offices were not open to officer-members who were not Old boys. This restriction was, however, removed as soon as it was realised that there was some friction and unpleasantness; and we are glad to say that all the offices of the Union have since been held by Officer-members who were not Old boys and by Old boys as well. The enormous amount of selfless work done with cheerfulness and enthusiasm by successive Presidents, Vice-Presidents, Secretaries and Treasurers, Editors and Managers of the Journal, members of the Council and of the Executive Committee and special Sports and Entertainment Sub-committees deserves a number of separate articles.

For several years, all were Life Members; there were Ordinary Life Members who paid a subscription of Rs. 5 and First-Class Life Members who paid Rs. 10, while Patrons gave a donation of Rs. 100. Student-members paid a Rupee every year during the college course and paid the balance of Life Membership when they left the College, and it was a common practice in those days for old students giving authorisation letters to the General Secretary to receive their caution money from the Principal towards the payment of their Life subscriptions.

The Union started with an Annual in the first year, was conducted as a Quarterly for about three years and has since been a Monthly all along. It was an understanding that every member should purchase a copy of the Journal and even the editor was not exempted from paying the subscription for the Journal, which was then Rs. 2 per annum.

The Journal of Madras Agricultural Students' Union was started as an Old Boys' Magazine and was intended to record personal events and personal experiences rather than functioning as an Agricultural Journal. It was soon felt that the Journal should cater to a wider public as several land-holders came to subscribe for the paper. The work of editing, publishing, and despatching of the Journal was all done by a few enthusiastic members of the staff of the College, assisted by some of the student representatives. There was always an Editorial Committee but the brunt of the work fell on the shoulders of the Editor and on the Manager. Some of the old boys sent contributions based on their practical experience and observation and, when these contributions were always sent officially through the superior officers concerned, it sometimes happened that some of the younger Agricultural Officers were snubbed for wasting time in writing articles. It is to the credit of Madras that the Madras Agricultural Journal, as it is now called, stands ahead of similar journals started in some other Colleges though the Madras Agricultural Journal has never received any financial aid from the Government and although all the work of editing and conducting the journal has been done in an honorary capacity by officers who have to turn out daily their routine work for at least six hours in the field and laboratories.

Apart from the Journal which demands day-to-day attention there have always been Annual functions, no less important. The College Athletic Sports are run by the Union. The College Day Celebrations are arranged for by the Union, and the holding of the Agricultural Conferences which have attracted considerable attention all over the country are also organised under the auspices of the Union.

The Madras Agricultural Students' Union is a unique organisation, has done considerable amount of useful work so far and is capable of doing much more. Hundreds of personal reminiscences flash through my mind and as many suggestions for improvement occur to me. As

this article has however, come to some length, I shall close it with the following queries :—

Are you eligible to become a member of the M. A. S. U. ?
Have you already joined the M. A. S. U. ? If not, why not ?
How can any organisation put forth its best, if all those who are eligible to join it have not done so ?
Do you witness the College Day Celebrations ?
Do you see the College Sports ?
Do you attend the Annual Conferences, if not, why not ?
If you do, how can you honestly take part in these functions, without being a member of the Union ?
Do you ever read the Madras Agricultural Journal ?
Do you subscribe for the Journal ? Do you contribute articles to the journal ? If not, why not ?
Have you ever been deputed to attend the Annual day and have you not felt a thrill when you meet the alumni of your Alma mater ?
How can an *Esprit de Corps* be created and maintained, unless all the devotees at the shrine of Agriculture join the Union ?

It is never too late to mend. The inclusive subscription for membership and Journal is so small. Join the Madras Agricultural Students' Union at once.

II. Representation of Agricultural Education in the University Bodies.

An Appeal to Graduates of the Agricultural Department.

I have had the honour of being your elected representative on the Madras Senate for five terms, on the Academic Council for four terms and on the Syndicate for two terms ; and, although I feel active enough to carry on, I think the time has arrived for me to retire from the above university bodies. Agricultural Education is now represented on the Senate by the Principal, and on the Academic Council by the Principal and two members of the teaching staff elected by themselves. You will all agree with me that this is not sufficient representation for us in the University of Madras and that there is need for us to secure a more adequate representation. A number of points must be constantly borne in mind to ensure success in the elections to the different University Authorities.

As regards the Senate, the election from the Registered Gaduates' Constituency is by proportional representation with the *Single Transferable Vote.* The first requisite is that all those, eligible to register— those who have passed any Degree examination of the University of Madras of seven years' standing and who have also taken the Degree in person or in absentia prior to August 1938—should

register themselves before the electoral list is closed for the next election. In the absence of definite information, I would suggest graduates to register at once, at any rate, before the end of August 1938.

ii. There may be some who have passed a University examination seven years ago; but who have not taken the Degree yet. Until they take the Degree, they are not Graduates of the University, nor are they eligible to add the titles of their Degrees after their names. Such persons are requested to take their respective Degrees, in person or in absentia, at the next Supplemental or Regular Convocation.

iii. The Life Registration fee of Rs. 5 is not so great as to prevent a Graduate from exercising his privilege in elections.

iv. When all those, who are eligible to register, have registered, we should see that we do not fritter our votes away, nor yield to persuasions of friends; but should, on our honour, solidly give the First Preferential Vote to our own selected representative. Who should be our representative may be decided by a Committee elected by ourselves for the purpose. The Committee of the Madras Agricultural Students' Union may be entrusted with this task, in the first instance, with power to co-opt.

v. If the South Indian Teachers' Union issues manifestoes for the election of their own teacher-representatives and if the Medical Graduates vote only for their medical friends, it is all the greater reason why the small body of the Registered Graduates of the Agricultural Department should solidly support their own representative.

vi. One of the two teacher-members of the Academic Council should always seek election to the Senate. One seat out of 20 seats by a straight vote of 200 members is not too much to ask in the interests of Agricultural Education and we are sure to succeed.

vii. I am sorry that the recommendations of the Board of Studies in Agriculture to the Syndicate to appoint one of the Research Officers as an Honorary Reader has not been accepted. An Honorary Reader has to give at least four advanced lectures every year and will have the privilege of being an ex-officio member of the Academic Council. The last word has not been said on the subject, and we hope that the Syndicate will take a more sympathetic view of the recommendation of the Board in succeeding years. Meanwhile, it is a suggestion to the Principal of the College to stress this point on the Syndicate.

viii. It is not a mere sentiment but an absolute necessity that there should be one representative of Agricultural Education on the Syndicate. Either the Principal or some senior officer of the Department, with the co-operation of the Principal, should seek election to the Syndicate either from the Senate or from the Academic Council. The election is by straight votes, one out of eight from the Senate and

one out of three from the Academic Council, out of a total of about 200 members in each.

ix. Considerable amount of canvassing is essential in all these elections and it should be an understanding among all officers of the Department to help in such canvassing. In addition to the personal manifestos of each candidate, a special Appeal may be sent, on his behalf, under representative signatures, or under the auspices of the M. A. S. U.

Correspondence with regard to these elections will be immense and may be entrusted to an energetic young man, resident at the Agricultural College Estate, who may be co-opted, if desired, as a member of the Committee of the M. A. S. U. for this purpose. All postage, stationery and printing charges incurred by him should be paid for by the selected candidates who seek election to the respective University Authorities and an advance of, say, Rs. 25 may be taken from each candidate. The S. I. T. U. levies a similar charge for all the candidates put up by them for election.

While I may not be able to do much canvassing, I shall always be glad to render all possible help towards securing adequate representation of Agricultural Education in all University Authorities.

It is also worth while trying to secure some of our representatives on the Andhra and Annamalai Universities.

Cheerio, Brother-Graduates.

EXTRACTS

A Labourer's Square Meal. The following Press Note has been issued from the Nutrition Research Laboratories, Coonoor.

A manual labourer needs at least two square meals a day. It is often impossible for him to return home to consume his midday meal and he naturally cannot afford to go and eat in a hotel. The meal, which he must perforce carry with him, should have the following qualities :—

(1) It should be sufficient in quantity and well balanced, i. e., contain the essential nutritive elements in correct proportions. (2) It should be cheap, made of easily available foods, and be simple to prepare. (3) It should be easy to carry, e. g., it should be solid to avoid the possibility of spilling, small in bulk, and not require a special utensil to contain it. (4) It should remain fresh and palatable for a number of hours.

Suitable "*missi chapatties*" may be made from the following :—

The constituents; whole wheat flour 10 ozs., Bengal gram flour 2½ ozs., onions ¾ oz., fenugreek leaves (or any other green leaves) ½ oz , milk 1 oz., ghee or butter ¼ oz. (except ghee) are mixed water being added and the whole kneaded into a dough. *Chapatties* are made from the dough in the ordinary way, good thick *chapatties* being recommended, since these remain fresh longer than thin ones. Subsequently, ghee is smeared on the *chapatties*. The weight of the whole meal is about 1 lb. It will supply about 1,300—1,400 calories, which is approximately half the daily requirement of a labourer, and about 50 grammes of protein.

The mixture is rich in vitamins and mineral salts. If fresh milk cannot be obtained, "*Khoa*" or skimmed milk powder can be used as an alternative. For those who can afford it, the addition of a greater quantity of milk, or an egg, to a dough may be recommended.

Such a meal is easy to carry folded in a broad leaf wrapped in paper. It remains fresh and palatable for a number of hours and can be eaten with no accessories except water. Its cost is about one anna. It can be recommended for travellers, picnic parties, etc., as well as for out-door labourers. (*The Mysore Economic Journal*, November 1937).

The World's Largest Plough. Several years ago, floods near Santana, California, buried fertile peat soil under several feet of silt and sand. Messrs. Post Bros. tractor rental service have since that time been building expressly designed and constructed ploughs to turn under the sand and bring the good soil back to the surface again.

The gigantic implement is their latest and largest example. Working 6 ft. deep it is estimated that the plough is constantly turning and lifting 5 yds. of soil as it moves through a field. The hydraulic lift used to raise it out of work has a pressure of 750 lbs. per sq. in., and is operated from the immediate tractor.

With three "Caterpillar" track type tractors hitched to the plough, about ½ acre per hour can be covered. It is said that often the increased yields obtained from land so treated will pay in a single season for the cost of this aptly styled "super ploughing job". (*The Implement and Machinery Review*, October 1937).

Synthetic Silk from Milk. Mr. Benjamin Roos, forty-one years old German Chemist, now working in England, is trying to produce a perfect synthetic silk from milk. Already he has been ten years on his task, and has made silk from milk in his laboratories, silk of fine texture and colour. In 1931 Mr. Roos, who lives at Prince of Wales-terrace, Kensington W., sent Government analysts in Berlin a sample of real silk and a sample of his own invention. The analysts declared it was impossible to distinguish between them.

Mr. Roos is not satisfied. So far he has spent more than £ 25,000 in research work, and for years has kept laboratories going in four countries. But always the secret of combining in his product every quality of the finest silk has eluded him. He has set himself to obtain five essentials—beauty, colour, strength, elasticity and non-shrinkableness. At present he can combine up to any four of these qualities but the remaining point of perfection escapes in the process.

Silkworm Diets for Cows. Mr. Roos has now succeeded in a remarkable experiment. He is arranging for two cows to be fed for three weeks on mulberry leaves, which is the only diet of the silkworm. "I intend taking two cows in fine condition and have them left to pasture in the ordinary way for a week," he declared. "Then I will analyse their milk, the butter made from it, and the casein remaining in the skimmed milk. Casein is the raw material from which I make my synthetic silk. Next, the cows will have a proportion of mulberry fed them. The same tests will be carried out. Later I hope to feed them for three weeks almost entirely on mulberry leaves, again testing the results. If the cows fed on mulberry leaves produce casein which is more suitable for my silk than that from ordinarily fed cows I shall attempt to make a chemical analysis to establish the difference between the two caseins. If the chemical constituents of this difference are once ascertained it should be possible to improve the normal casein by manufacturing the difference in the laboratory".

His Experiment. Mr. Roos has already been offered the cows and the necessary equipment for his experiment, but he is still in need of mulberry

leaves. An average cow, every day it is milked, can produce enough casein to manufacture nearly 21 lbs 8 ozs. of synthetic silk. This is after butter has been made from the milk.

It takes more than 30,000 silkworms, who will eat a ton of ripe mulberry leaves to yield 12 lbs. of raw silk properly reeled. (*The Sunday Statesman*, 27 June 1937.) (*The Punjab Agricultural College Magazine* Vol. V. No. 1. October '37.)

Influence of fertilisation of Washington Navel Oranges on quality and composition of fruit. The report of trials on the above emphasizes through-out the importance of a balanced nutrient solution. In this connexion the general conclusion is that, although fundamentally one nutrient is as important as another, the most important two substances that have to be present in the correct proportion and in considerable quantities are nitrogen and phosphorus. The proportion and concentration should be such that considerable quantities of both substances would be absorbed and this would have the following effects:—

High Nitrogen : High crop ; low wastage.

High Phosphorus : Thin rind-high Juice (on whole fruit basis) ; low acid.

1. Fruit from all plots of all treatments were analysed for phosphorus, potassium, calcium, nitrogen, ash, dry weight, sugar, total soluble solids, acid, thickness of rind, and wastage due to mould.
2. A high phosphorus content in the fruit juice causes a low acid content. On the other hand, a high potassium content causes a high acid content.
3. A high phosphorus content in the fruit causes a thin rind and a low phosphorus content a thick rind.
4. High nitrogen content of fruit causes a low percentage wastage due to mould.
5. The juice content of the pulp has not been affected by any of the treatments although treatments have affected thickness of rind, which would accordingly be reflected in juice content when the latter is calculated on the weight of whole fruit, including the rind.
6. Nitrogen applications to the soil markedly depress the absorption of phosphorus into the fruit, unless large quantities of available phosphorus are present in the root zone (*Farming in South Africa*, Vol. XII, No. 138, September '37).

Silica Dust as an Insecticide. Many substances used as insecticides are actual insect-poisons, but various non-poisonous materials in the form of very fine dust have also been tried at different times, their lethal effect being more of a physical nature. In a series of recent trials one of the most promising of these materials was a proprietary silica dust stated to consist of a pure quartz sand, ground to such a degree of fineness that the particles approach colloidal size, and to contain 98 per cent of silica, with only very small quantities of aluminium, iron, calcium, and magnesium compounds ("Versuche zur Bekampfung des kornkafers mit Staubmitteln" by B. Germar, *Z. Angew. Ent.*, 1936, 22. 603—630),

The practical trials were made with the granary weevil (*Calandra granaria*). It is believed that the fatal effect of the dust is due to a withdrawal of water from the tissues of the insect, owing to the large increase in body surface caused by the adherent dust. The effect of the dust is consequently dependent closely to the body of the insect, but the age of the insect is also a factor, the younger individuals being definitely more readily susceptible than the older. The temperature and the relative humidity of the atmosphere are also important.

The treated grain should contain 1 per cent by weight of the dust, which is best applied in the autumn or at the end of the winter, and should, of course, be stored in a dry place. The dust is non-toxic, and is removed by the usual processes preceding milling.

The treatment is said to be effective with regard to the existing weevil population, in retarding oviposition and hence preventing reinfestation, and to be economically practicable from the point of view of cost and ease of application. (*Bulletin of the Imperial Institute*, Vol. XXXV No. 3. 1937.)

Agricultural Jottings.

By THE DEPARTMENT OF AGRICULTURE, MADRAS

The Preservation of Cattle Manure. Cattle manure is collected and stored by cultivators, generally in an unsatisfactory manner. There is loss of manurial ingredients occurring in the manure heaps made by them and such losses could be easily avoided. When the cattle dung, waste fodder and other farm waste available are properly stored in pits day after day, there is fermentation taking place in the materials leading to their disintegration and when well made, the resulting material is rich, black in colour, uniform and powdery in appearance. When the manure is heaped in the open, the decomposition of the constituent materials is incomplete and a fair part of the heap is dried up and is in lumps. There is considerable aeration inside the heap and volatile poducts of decomposition, which are rich in nitrogen are lost. During rains, the heaps are soaked with water and the soluble portions of the manure rich in nitrogen are washed away and the cultivator is again a loser.

The preservation of the cattle manure can be done easily without much trouble or increased expenditure. It has to be borne in mind however that both dung and urine of cattle contain valuable manurial ingredients and have to be collected without allowing any to be wasted. The losses in the making of the manure are minimised by collecting the manure in pits, preferably provided with impermeable sides and flooring, and a roofing to guard against rain and sun. The sides of the pit should be raised over the ground level, to prevent rain water from the surrounding areas getting into the pit. All available organic wastes can be added to the manure pit. The manure in the pit has to be levelled once a fortnight and covered with a thin layer of earth, preferably tank silt. These help to increase the bulk of the manure. The silt helps to fix the volatile gases resulting from the fermentation of the manure and prevents loss of valuable manurial ingredients.

There are a few systems of stalling the animals and collecting and preserving manure that are satisfactory. The cattle shed may be provided with an impermeable flooring to permit urine being collected and led to the manure pit by means of suitable drains. The sheds can be washed every day and the washings also led into the manure pit. This is called the 'Byre System'. The byre or the cattle shed can be kept clean and tidy and is therefore pre-eminently suitable for housing cows and calves in particular.

It is not necessary to have pucca flooring for all classes of cattle. The working animals can be stalled in what is known as a loose-box, which is a combination of a cattle shed and manure pit requiring very little attention. Pits are dug to a depth of 2½ to 3 feet sufficiently large to house the animals and the entrance is made lightly sloping to permit the cattle to get in and get out easily. A feeding trough may be built on one side or a movable manger put in. The waste fodder and waste products of the farm like dried leaves, may be spread on the floor to absorb the urine voided by the animals and to provide them bedding. The dung dropped by the cattle may be spread evenly over the floor every morning and a layer of waste spread over it. The manure obtained from the loose box is very rich. Animals have been stalled in loose boxes in the various agricultural stations for the past 30 years and over and their health has not been affected.

The Loose-Earth System. This is a modification of the byre-system. The flooring is made with a layer of loose sand and silt, preferably in the proportion of 3:1, to a depth of 6 to 9 inches. The loose soil absorbs all the urine and the moistened soil is removed and added on to the manure in the pit and the moistened soil is renewed whenever necessary. This system should appeal to the cultivator in tracts where there is scarcity of fodder and waste matter in general and which could not therefore be used to absorb the urine and excess moisture in the dung.

A short note on the cultivation of Plums on the Nilgiris. Experience during the last 15 years has shown that Coonoor, Kotagiri and the surrounding villages are quite suitable for the cultivation of Japanese plums. A large number of varieties of plums have been under trial at the Pomological Station, Coonoor, and it has been found that the varieties 'Aloo-Bokhara', 'Hale', 'Rubio', 'Abundance', and 'Shairo' grow and crop very well.

'Aloo-Bokhara' is a cooking variety, but a very prolific bearer, producing 2,000—3,000 fruits per tree. 'Hale' is a good eating plum and an equally prolific bearer as the variety 'Aloo-Bhokara.' 'Rubio' also is a fairly good eating plum and a fairly good cropper, bearing 800—1,000 fruits per tree. This is the earliest variety of eating plums cultivated on the Nilgiris and this is good for jam making. The varieties 'Abundance' and 'Shiro' are very good desert plums, but produce only 150—200 fruits per tree.

Country peach is indigenous to the Nilgiris and its seedlings have proved to be a satisfactory stock for plums. The method of propagation is by "shield" budding and nearly cent per cent success is obtained by this method if the budding is done during dry weather. The best period for this operation is during the months of December to January.

As some varieties of plums are wholly or partially self-sterile and as good results are obtained by cross pollination, it is advisable to plant varieties alternately instead of each variety in separate blocks. The spacing to be given depends upon the habit of individual varieties, as some varieties are vigours growers and some intermediate and dwarf types. The minimum spacing that should be given is 15 ft. But varieties like 'Abundance', 'Shiro' and 'Aloo-Bokhara' require a minimum spacing of 20 ft. One year old budded plants may be planted in prepared pits 3 ft. cube, keeping the union of the scion and stock above the ground level.

It may be necessary to water the plants during the dry months for the 1st year after planting. Afterwards they do not require any watering. During the first year of planting, a periodical inspection of the trees should be made and long growths should be pinched off. When the plants have made some growth, the trees have to be pruned to give them a good shape and all the superfluous and badly placed branches are to be removed leaving strong and healthy branches for further growth and fruit production.

Plum trees bear fruits on the growth of the preceding year and on fruit spurs. The aim of the fruit grower should be to stimulate a superfluous production of fruit spurs and small shoots on the main branches. A judicious pruning every year during the winter months is necessary for good fruit production.

In the case of self-fertile varieties of plums judicious pruning and manuring alone is necessary to guarantee a good crop if weather conditions are favourable at the time of flowering. But in the case of self-sterile varieties artificial pollination is necessary for fruit production. The best time for cross-pollinating is between 1 p. m. and 3 p. m.

Other varieties of plums that can be recommended are 'Kelsey', 'October Purple', 'Wright's Late', 'Czar' and 'Satsuma'. These, excepting 'Czar', are late varieties and start ripening only by the end of June.

Trials with cotton in the second crop season—Agricultural Research Station, Maruteru. Preliminary trials during 1930—1931 in wet-land with cotton sown in September at the Agricultural Research Station, Maruteru, disclosed clearly that such cultivation involving the giving up of the usual first crop paddy would not commend itself for the adoption of the wet-land delta ryot. The proper course appeared to lie in the amelioration of suitable cultural and cultivation methods to grow cotton during the off-season following the harvest of first-crop. The fact that only a portion of the entire wet-land first-crop area in the West Godavari Delta, is put under second crop, added practical and economic importance to this view. The later trials with cotton were therefore designed to elucidate the proper time and '*modus operandi*' for following up a short-duration or medium-duration paddy crop with cotton. The experience gained in subsequent seasons indicated that under conditions obtaining at Maruteru the best time for sowing was during the early part of November after the harvest of early main crop paddy *basangi.* Regarding the method of sowing, dibbling seeds in plough-furrows made 2½ feet apart in unploughed land, and passing the brush-harrow for covering, appeared most suitable. One irrigation about 2 months after sowing was found necessary and beneficial. The bullock-drawn junior-hoe frequently used for intercultivation during the growth stages of the crop, helped to conserve soil-moisture. Pickings of kappas took place during April—June.

Having arrived at the best time for sowing and most suitable method of cotton-cultivation in single-crop paddy-land after paddy harvest, it remained to determine the variety most suitable for such conditions. Trials to ascertain the most suitable variety are still proceeding, but it may be stated that yields of a little over 500 lbs. of kappas per acre have been obtained.

It might however be stated, that the favourable economic considerations which are bound to commend cotton-growing to the Godavari wet-land ryots' attention are, (i) the land lying normally fallow and unremunerative after first crop harvest till the following '*sarva*' planting, (ii) the second crop paddy zone being restricted to a portion only (about one-fifth) of the first crop area, and (iii) the paddy ryots' enforced idleness in the off-season owing to the lack of other subsidiary occupations.

Association of Economic Biologists, Coimbatore.

A meeting of the Association was held on December 1, 1937, at which the following paper was presented :—

Investigation on the Decomposition of Molasses under Paddy Soil Conditions *By P. D. Karunakar, M. Sanyasi Raju, T. Rajagopalan and M. Sundaram.* When paddy seedlings were transplanted soon after application of molasses to paddy soils (wet lands, Central Farm, Coimbatore,) they were found to die in great numbers. The present investigation was undertaken to determine the causes for their mortality and if possible, to find out the proper methods of applying molasses to soil, which may prove beneficial and not harmul to the seedlings. This investigation naturally divided itself into three different phases of study, namely, (1) agronomic, (2) biochemical and (3) biological phases.

These studies indicated that when molasses was allowed to ferment under paddy soil conditions, under artificial anaerobic conditions in soil and also in liquid medium, there was a considerable evolution of inert gases such as, carbon-dioxide, hydrogen and methane, as well as the production of organic acids, chiefly,

acetic, butyric and lactic acids during the earlier stages of fermentation. It was, therefore, found that the death of seedlings was due, (1) to one of simple asphyxiation by carbon dioxide and hydrogen, or in other words, displacement of oxygen by the gases mentioned above at the root zone of the seedlings, and (2) to the production of organic acids and the dissolution effect they may have had on minerals.

It was noticed in field as well as in pot culture house that these effects, both gaseous and acidic, passed off after a certain time, usually 2 weeks to a month, depending upon the biological population of the soil and the amount of molasses added, leaving the soil once again fit for the growth of seedlings (Abstract).

Crop and Trade Reports.

Paddy—1937-38—Second Fore-cast Report. The average of the areas under paddy in the Madras Presidency during the five years ending 1935—36 has represented 15·3 per cent of the total area under paddy in India.

The area sown with paddy up to 25th November 1937 is estimated at 8,595,000 acres. When compared with the area of 8 504,000 acres estimated for the corresponding period of the previous year, it reveals an increase of about 1·1 per cent.

The increase in area occurs in the Circars (Vizagapatam excepted), Cuddapah, the Carnatic districts, Chittoor, Trichinopoly, Tanjore and the Nilgiris. There has been a marked increase in Nellore (100,000 acres) and South Arcot (71,000 acres) and at the same time a large reduction in area in Vizagapatam (100,000 acres) and Tinnevelly (75,000 acres).

The first crop has been generally harvested throughout the Presidency, Normal yields have been reported from Kistna, Kurnool, Cuddapah, Nellore. Salem, Coimbatore, Tanjore, Madura, South Kanara and the Nilgiris. The yield is expected to be below normal in the other districts. The crop has been affected by excessive rains in parts of Chingleput, South Arcot, North Arcot, and Trichinopoly; in the other districts it has suffered to some extent from drought.

The seasonal factor for the Presidency works out at 95 per cent, of the average as against 98 per cent in the corresponding period of the previous year.

The wholesale price of paddy, second sort, per imperial maund of 82$\frac{2}{7}$ lb, as reported from important markets on 6th December 1937 was Rs. 2—15—0 in Madura, Rs. 2—12—0 in Vellore and Chittoor, Rs. 2-11-0 in Tinnevelly, Rs 2-10-0 in Trichinopoly, Rs. 2—8—0 in Vizianagaram and Hindupur, Rs. 2—7—0 in Masulipatam, Rs. 2—6—0 in Guntur and Kumbakonam, Rs. 2—5—0 in Ellore and Bezwada, Rs. 2—4—0 in Rajahmundry and Cuddalore, Rs. 2—3—0 in Cocanada, Rs. 2—2—0 in Anantapur and Conjeeveram, Rs. 2—1—0 in Negapatam and Rs. 2—0—0 in Mangalore. When compared with the prices published in the last report, i. e., those which prevailed on 8th November 1937, the prices reveal a rise of about eight per cent in Hindupur and Tinnevelly, six per cent in Negapatam, five per cent in Vellore, and three per cent in Conjeevaram, and a fall of about six per cent in Anantapur, five per cent in Kumbakonam, three per cent in Coconada and Bezwada and two per cent in Madura, the prices remaining stationary in the other centres. (*Director of Industries, Madras.*)

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1937 to 10th December 1937 amounted to 502,008 bales of 400 lb. lint as against an estimate of 533,100 bales of the total crop of 1936-37. The receipts in the corresponding period of the previous year were 603,279 bales 419,408 bales mainly of pressed cotton were received at spinning mills and 204,373 bales were exported by sea while 103,784 bales were imported by sea mainly from Karachi and Bombay. (*Director of Agriculture, Madras*).

College News and Notes.

Students' Corner: Hockey. The match in connection with the Inter-collegiate Tournament which ended in a draw on the 15—10 -'37, was replayed on 19—11--'37 with the local Government college. Our college won the same by 10 goals to nil.

The next match of the above Tournament was played on 27—11—'37 with the Maharajah's College, Ernakulam, in which our college was defeated by 0 to 3 goals.

Volley ball. A friendly match was arranged on 17-12-'37 between our college and the Y. M. C. A., Coimbatore, on the college grounds. The latter won the match.

Our New Patron. We are glad to announce that Sri Ramachandra Ananga Bhima Deva Kesari Gajapathy, Rajah Saheb of Bodokhemidi, Berhampore, Ganjam, has graciously become a patron of our Union.

Our members. We are glad to learn that Rao Bahadur M. R. Ramaswami Sivan has been chosen as one of the representatives of the Universities on the crops and soils wing of the Board of Agriculture in India.

Rao Bahadur T. S. Venkataraman, C. I. E., Imperial Sugarcane Expert, has been elected as Honorary member of the South African Sugar Technologists' Association. We are very glad to hear that he is the only one elected to that honour outside South Africa.

Madras Agricultural Sub. Service. We note from the Fort St. George Gazette, dated 30th November 1937, that 8 temporary posts (for 1 year) have been sanctioned, for the performance of work in co-operative societies or union of such societies of sugarcane growers.

Visitors. Mr. P. H. Rama Reddy, M. A., I. A. S., Director of Agriculture, Madras, visited the College and Research Institute on the 14th November.

Mr. T. G. Rama Iyer, Director of Agriculture, Mysore, visited the Research Institute and Breeding Stations on the 27th and 28th November 1937. He stayed with Rao Bahadur T. S. Venkataraman, C. I. E., Government Sugarcane Expert, at the Imperial Cane Breeding Station.

Mr. A. B. H. Khoorshid, B. A., M. S., Economic Botanist, Hyderabad, visited the Research Institute and Breeding Stations about the middle of the month.

Estate activities. Some of the officers in the Estate performed Maha Abhishekham and Santharpanai at the Marudha Malai temple on Sunday the 12th December 1937.

The Dhanurmas Bhajana was started in right earnest on the 15th of December.

Hosur Cattle Farm Labourers' Club. The opening ceremony of the Hosur Cattle Farm Labourers' Club located at the old cricket Pavilon was performed by the Director of Agriculture on the 27th October 1937.

Weather Review—NOVEMBER 1937.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·1	-3·9	41·5
	Calingapatam	...	-3·9	29·7
	Vizagapatam	...	-3·8	28·9
	Anakapalli*	0·3	-3·6	40·2
	Samalkota*	...	-3·5	35·9
	Maruteru*	...	-3·5	33·8
	Cocanada	0·2	-5·2	40·4
	Masulipatam	1·1	-4·6	34·8
	Guntur*	0·1	-3·5	32·3
Ceded Dists.	Kurnool	...	-1·1	22·1
	Nandyal*	...	-1·6	19·0
	Hagari*	0·1	-1·5	15·7
	Bellary	...	-2·2	15·0
	Anantapur	0·5	-2·3	31·3
	Rentachintala	...	...	32·1
	Cuddapah	4·1	+0·5	25·4
	Anantharaju-pet*	12·8	-0·4	42·3
Carnatic	Nellore	17·7	+6·5	66·2
	Madras	4·6	-9·7	34·1
	Palur*	...	...	...
	Tindivanam*	26·0	+15·0	54·8
	Cuddalore	29·4	+14·3	52·2
Central	Vellore	15·6	+8·7	48·9
	Salem	3·5	-0·2	27·9
	Hosur*	...	...	...
	Coimbatore	7·1	+3·3	24·8
	Coimbatore A. C. & R. I.*	2·9	-1·6	20·9
	Trichinopoly	7·0	+1·4	39·8

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	25·8	+8·1	51·8
	Aduthurai*	23·9	+13·9	46·0
	Madura	7·5	+2·5	22·4
	Pamban	15·2	+3·2	40·5
	Koilpatti*	7·9	+1·3	23·5
	Palamkottah	7·8	+0·4	24·1
West Coast	Trivandrum	7·8	+1·2	58·3
	Cochin	6·1	-0·4	124·7
	Calicut	4·0	-1·4	125·7
	Pattambi*	3·2	-0·8	89·9
	Taliparamba*	...	...	...
	Kasargode*	1·7	-1·6	169·0
	Nileshwar*	0·4	-2·8	150·5
	Mangalore	0·4	-2·7	141·9
Mysore and Coorg	Chitaldrug	...	-2·3	17·4
	Bangalore	1·6	-1·3	30·8
	Mysore	2·3	-0·2	40·2
	Mercara	1·7	-1·5	117·4
Hills	Kodaikanal	10·5	+2·3	65·0
	Coonoor	0·4	...	56·3
	Ootacamund*	7·5	+2·7	56·1
	Nanjanad*	3·5	-0·3	47·4

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in Fort St. George Gazette.

During the month five troughs of low pressure were recorded and of these three were formed in the Southwest Bay of Bengal, on 9th, 14th, and 28th, while the other two were formed in the Arabian Sea on 4th, and 16th. The depression which formed on 14th in the southwest Bay of Bengal, caused widespread rain with locally heavy falls in southeast Madras and local rain in Malabar, Mysore and the Madras Deccan, with a few falls in the North Madras Coast. The trough of low pressure, which appeared on 4th to the west of Ceylon moved northwards into the Central Arabian Sea on 7th and later moved in a westerly direction, while that formed on 16th extended over the east Arabian Sea and became less important on 18th.

Throughout the month, the monsoon was active in the South of Bay of Bengal, Southeast Arabian Sea and in the neighbourhood of Ceylon. It caused widespread and local thundershowers in the southern half of the peninsula.

Local and general rains were not uncommon in southeast Madras, Mysore, Malabar, and North Madras Coast during the month.

Rainfall was in large defect in Circars, Ceded Districts, Mysore and Coorg, while it was markedly in excess in other stations of the Presidency.

Chief falls.

Madras	5·7″	on 16th.
Nellore	3·7″	„ 18th.
Cuddalore	9·3″	„ 14th.
Vellore	9·2″	„ 16th.
Negapatam	4·8″	„ 3rd
Cochin	3·1″	„ 19th
Anantharajupet.	3·9″	„ 15th.
Tindivanam	8·7″	
Aduthurai	5·1″	

Special falls of heavy rainfall.

Vanoor	9·7″	on 15th.
Portonova	8·1″	„ „
Tindivanam	7·7″	„ „
Panruti	7·7″	„ „
Villupuram	6·8″	„ „
Chidambaram	6·8″	„ „
Ulundurpet	6·0″	„ „
Tirupattur	5·5″	„ „
Jeyankondan Solapuram	8·1″	
Peraiyur	5·7″	„ 14th.
Tirupattur (Madura)	5·4″	„ 20th.
Pechipara	6·0″	„ 16th.

Weather Report for the Reasearch Institute Observatory:

Report No. 11/37.

Absolute Maximum in shade	88·0°F.
Absolute minimum in shade	62·0°F.
Mean maximum	82·2°F.
Departure from normal	–2·5°F.
Mean minimum	69·0°F.
Departure from normal	+0·3°F.
Total rainfall	2·91″.
Departure from normal	–1·62″.
Heaviest fall in 24 hours	0·78″ recorded on 5th.
Total No. of rainy days	9 days.
Mean daily wind velocity	0·40 M. P. H.
Mean Humidity	81·4%.
Departure from normal	+0·1.

Summary. The monsoon was fairly active and rains occurred mostly during the first and third week. Rainfall was in large defect and the heaviest fall of 0·78″ was recorded on 5th. The mean maximum was below normal by 2·5°F. while the mean minimum and humidity were almost normal. The skies were moderately to heavily clouded.

P. V. R. & P. G.

Errata (Total rainfall from January 1st, 1937, for Coimbatore, A. C. R. I., in the report No. 10/37 should be corrected as 18·0″ instead of 15·9″).

Departmental Notifications.

1. Transfers.

Name of officer.	From	To
Mr. M. K. Swaminatha Ayyar	F. M. Coimbatore	A. D. Dindigul.
„ D. C. Hanumantha Rao	A. D. Tenali	A. D. Gannavaram.
„ G. L. Narasimha Rao	A. D. Gannavaram	A. D. Kovur.
„ K. Raman Menon	F. M. A. R. S. Nanjanad	A. D. Coonoor.
„ M. Kandaswami	A. D. Avanashi	F.M.A.R.S. Nanjanad.
„ K. H. Subramania Iyer	A. D. Kugalur	A. D. Avanashi.
, C. S. Sankaranarayana Iyer	A. D. Coimbatore	A. D. Kugalur.
„ P. K. Parameswara Menon	A. D. Namakkal	A. D. Dharmapuri.

2. Leave.

Name of officer.	Period of leave.
Mr. N. Srinivasa Rao, A. D. Hosur	L. a. p. for 2 months and 20 days from 11—12—'37.
„ M. Rayappa Pillai, Asst. in Paddy, A. R. S. Pattambi	L. a. p. for 2 months from 18—11—'37.
„ B. Shiva Rao, A. D. Vizagapatam	L. a. p. for 2½ months from 3—1—'38.
„ K. M. Krishna Menon, Asst. in Chemistry Section	L. a. p. from 1—12—'37 to 23—12—'37.

ADDITIONS TO THE LIBRARY, NOVEMBER 1937.

A. Books.

1. *Report of the Work of the I. C. A. R. in applying Science to Crop Production.* Russell, J. (1937). 2. *Report on the Development of the Cattle and Dairy Industries of India.* Wright, W. C. (1937). 3. *Economics of Agriculture.* Van Der Post, A. P. (1937). 4. *Indian Agricultural Economics.* Patel, A. D. (1937). 5. *Bio-Chemistry applied to Malting and Brewing.* Hopkins, R. H. and Crause, C. B. (1937). 6. *Indian Vegetable Oils (Indian Industrial Res. Bull. 10).* Brodie, N. (1937). 7. *Methods of Chemical Control for Cane Sugar Factories and Gur Refineries.* Indian Sugar Tech. Assn. Pubn. (1937). 8. *Labour Legislation in British India.* Pankaj Kumar Mukherjee. (1937). 9. *Laboratory Manual of Organic Chemistry.* Dey, B. B. and Raman, M. V. S. (1937). 10. *Fifth Progress Report of the Foot and Mouth Disease Research Committee.* H. M. Stationery Office Pubn. (1937).

B. Annual Administration Reports.

1. Mysore Agricultural Department Administration Report for 1935–36. 2. Report on Demonstration Work carried in the Southern Circle of the Agricultural Department, Central Provinces and Berar, 1936. 3. Rothamsted Experimental Station, Report for 1936. 4. Annual Report of the Department of Agriculture, Cyprus, for the Year 1936. 5. Annual Report of the Department of Agriculture and Forests, Palestine for the year ended 31st March, 1936. 6. Kenya Colony Agricultural Department Annual Report, 1936. 7. Tanganyika Territory Agricultural Department Annual Report, 1936. 8. Tanganyika Territory Reports from the General Experimental Farms, 1936. 9. Report of the Agricultural Department, Antigua, 1936 10. Report of the Agricultural Department, Dominica, 1936. 11. Report of the Agricultural Department, St. Vincent, for the year 1936. 12 Research Abstract Report of the Department of Agriculture, St. Lucia, 1936. 13. Oregon Agricultural Experiment Station—A Biennial Report of Activities and Accomplishments, 1932—1934. 14. Findings in Farm Science. Wisconsin Agr. Exp. Stn. Bull. 438. 15. A Year's Progress in Solving Farm Problems of Illinois, 1934—35.

C. Special Publications.

16. The Nutritive Value of Banana. *Columbia Uni. Pubn.* 17. Technological Reports on Trade Varieties of Indian Cottons, 1937. *ICCC. Tech. Bul. Ser. A 38.* 18. Wood's Challenge to Steel and Concrete; 19. Relative Economy of Wood, Steel, and Concrete Structures; 20 Manufacture of Small Dimension Stock—A New Rural Industry; 21. The Truth about Fire Hazard in Timber Structures; 22. Cheaper and Better Gable Roofing with Wood Shingles; 23. Treated Timber for Earthquake Resistant Structures; 24. Treated Wood Poles for Electric Distribution and Service; 25. Special Factors affecting Timber Design; 26. Better and Cheaper Fencing; 27. How to build Wooden Earthquake-and Storm-Proof houses; 28. Relative Cost of Treated Electric Poles and Overhead Construction in India and Abroad; 29. Treated Timber Bridges for Indian Highways and Railways; 30. Wood Versus Steel for Framed Buildings; 31. How to build Fire-resistant Timber Structures; 32. Wood is Good: Fire-proofing of Wood; 33. Treated Wood for Roof Trusses; 34. Treated Wood for Flooring; and 35. Treated Wood for Walls and Ceilings. *Dehra Dun For. Res. Ins. (Timber Dev. Sec.) Pub. Nos 1 to 11, 13, 15 & 18 to 23.* 36. White fish Meal as a food for Livestock. *Eng. Min. Agr. and Fish. Bul. 63.* 37. Technique of Grass Seed Production at the Welsh Plant Breeding Station; 38. Production

of Legume Seed; and 39. Collection of Native Grass Seed in the Great Plains, U. S. A. *Eng. Herbage Pub. Ser. Bul. Nos. 22, 23, & 24.* 40. The Grazing of Sheep on Improved Pastures: Its Effect on Superfine Wool. *Austr. Comm. C. S. and I. R. Pamphlet No. 71.* 41. Sheep Husbandry in Canada. *Canada Min. Agr. Pubn.* 42. Vegetable Growing in the coast Area of British Columbia. *Can. Agr. Dep. Pub. 572, 1937.* 43. Turkeys, their Care and Management. *Ibid. Pub. 587.* 44. Experiments in Egypt on the Interaction of Factors in Crop Growth: 7—The Influence of Manuring on the Development of the Cotton Crop; and 45. No. 8—Manuring of Cotton in Egypt. *Egypt. Roy. Agr. Soc. Bul. 31.* 46. Summary of Agricultural Legislation in Cyprus. *Cyprus Agr. Dep. Bul. 4.* 47. The Prevention of Diseases in Citrus Seed Beds; and 48. On the Biology of Black Scale Chrysamphalus aonidum L. in the Jordan Valley. *Palestine Agr. Res. Stn. Bul. Nos. 22 and 23.* 49. Virginia Tobacco fire-cured Type. *Tanganyika Terr. Agr. Dep. Pamphlet No. 11.* 50. Soybean Costs and Production Practices; and 51. Illinois Corn Performance Tests Results for 1936. *Illinois Agr. Exp. Stn. Bul. 428 and 429.* 52. Burning and Non-burning Strains of Tobacco Mosaic, etc. and 53. The Seasonal Course of Soluble Nitrogen and Phosphate Phosphorus in the Shoot Growth of Winesap Apple and Elberta Peach. *Kent. Agr. Exp. Stn. Bul. 361 and 367.* 54. A Study of the Body and Texture of Butter. *Minn. Agr. Exp. Stn. Tech. Bul. 11.* 55. Nitrogen and Carbohydrate Content of the Strawberry Plant. *Missouri Agr. Exp. Stn. Res. Bul. 252.* 56. Recent Investigations on the Control of Cedar—Apple Rust in the Hudson Valley. *N. Y. Agr. Exp. Stn. Bul. 678.* 57. Soil and Water Conservation in the Northern Great Plains. *U. S. Agr. Dep. Soil Conser. Ser. Region No. 9.* 58. Regulations for Warehousemen Storing Nuts. *U. S. (Bur. Agr. Eco.) SRA. 119.* 59. Milk Goats; and 60. How to fight the Chinch Bug. *U. S. Farm. Bull. 920 and 1780.* 61. Truck Crop Investigations: Control of the Potato-Flea Beetle *Epitrix cucumeris* Harris. *Virgin. Truck Exp. Stn. Pubn.* 62. Studies on the Parasitism of the Rust of *Acasia confusa* Merrill, *Maravalia Hyalospora* (Saw.) Diet: Reaction to the Rust of Maturity of Phyllodes; and 63. Relation of Temperature and Humidity to *Sphaerotheca fuiginea* (Schelecht.) Poll. with special reference to Germination, Viability and Infection. *Taihoku Phyto. Lab. Contr. 40 and 41.* 64. A Further Note on the Serological Studies of the Tobacco Mosaic Rearing Malformed Flowers; and 65. Preliminary Note on the Bacteriophage for *Bacterium citri* (Hasse) Dpidge. *Taihoku Misc. Rep. Nos. 3 and 4.*

D. Circulars, Leaflets etc.

66. Aphids. *Kent. Agr. Exp. Stn. Cir. 45.* 67. Factors affecting the Quality of Flue-cured Tobacco. *N. Carolina, A. E. S. Exten. Cir. 212.* 68. Flour-Mill Insects and their Control; and 69. Parasitization of the Mediterranean Fruitfly in Hawaii, 1914—1933. *U. S. Agr. Dep. Cir. 390 and 439.* 70. Arabica Coffee: Periods of Growth and Seasonal Measures. *Tanganyika Agr. Dep. Pamph. 9.*